Arizona Grade 6 Answer Key

Complete classwork, quiz, and unit test answers for all 140 days. Day and item numbers match the student workbook. Solution notes give the main calculation or reasoning; accept mathematically equivalent forms and valid alternate methods.

For drawings, check the listed coordinates, face labels, frequencies, or five-number summaries against the student's graph or model. A written answer without the requested model does not fully satisfy a drawing item.

Classwork: use the results to group students for feedback, rather than assigning a single high-stakes score. Revisit misconceptions before the next assessment.

Quizzes: 4 points each, 20 total. Award 2 for correct method or model, 1 for an accurate result, and 1 for the requested units, explanation, or check. For a simple item without a separate explanation requirement, award that final point for clear mathematical notation.

Unit tests: 5 points each, 100 total. Award 2 for a correct setup or model, 2 for correct calculation or reasoning, and 1 for units, interpretation, or the requested check. For a purely conceptual response, use 2 for a correct claim, 2 for sound evidence, and 1 for clear explanation.

Prior-unit review is exactly 20% of both question counts and possible points. Subparts stay within their numbered question and share its point allotment.

Suggested response: 80% or above on current-unit items indicates readiness to proceed; 60–79% indicates focused small-group support; below 60% indicates reteaching with concrete models. These are classroom planning suggestions, not Arizona proficiency cut scores.

Long Division and Place Value

Whole Numbers and Decimals

1. 73
Reasoning 43 ÷ 6: write 7, subtract 42, remainder 1; bring down the next digit: 18 ÷ 6: write 3, subtract 18, remainder 0. Check: 6 × 73 = 438.

2. 25
Reasoning 17 ÷ 7: write 2, subtract 14, remainder 3; bring down the next digit: 35 ÷ 7: write 5, subtract 35, remainder 0. Check: 7 × 25 = 175.

3. 42
Reasoning 25 ÷ 6: write 4, subtract 24, remainder 1; bring down the next digit: 12 ÷ 6: write 2, subtract 12, remainder 0. Check: 6 × 42 = 252.

4. 373
Reasoning 141 ÷ 38: write 3, subtract 114, remainder 27; bring down the next digit: 277 ÷ 38: write 7, subtract 266, remainder 11; bring down the next digit: 114 ÷ 38: write 3, subtract 114, remainder 0. Check: 38 × 373 = 14174.

5. 242
Reasoning 33 ÷ 14: write 2, subtract 28, remainder 5; bring down the next digit: 58 ÷ 14: write 4, subtract 56, remainder 2; bring down the next digit: 28 ÷ 14: write 2, subtract 28, remainder 0. Check: 14 × 242 = 3388.

6. 376
Reasoning 124 ÷ 33: write 3, subtract 99, remainder 25; bring down the next digit: 250 ÷ 33: write 7, subtract 231, remainder 19; bring down the next digit: 198 ÷ 33: write 6, subtract 198, remainder 0. Check: 33 × 376 = 12408.

7. 189 R 11
Reasoning 54 ÷ 29: write 1, subtract 29, remainder 25; bring down the next digit: 259 ÷ 29: write 8, subtract 232, remainder 27; bring down the next digit: 272 ÷ 29: write 9, subtract 261, remainder 11. Check: 29 × 189 + 11 = 5492.

8. 265 R 10
Reasoning 55 ÷ 21: write 2, subtract 42, remainder 13; bring down the next digit: 137 ÷ 21: write 6, subtract 126, remainder 11; bring down the next digit: 115 ÷ 21: write 5, subtract 105, remainder 10. Check: 21 × 265 + 10 = 5575.

9. 156 full packets; 11 cards remain
Reasoning 2351 = 15 × 156 + 11.

10. 270 full packets; 5 cards remain
Reasoning 3245 = 12 × 270 + 5.

Quotients with Zero Digits

Whole Numbers and Decimals

1. 104
Reasoning 7 ÷ 7: write 1, subtract 7, remainder 0; bring down the next digit: 2 ÷ 7: write 0, subtract 0, remainder 2; bring down the next digit: 28 ÷ 7: write 4, subtract 28, remainder 0. Check: 7 × 104 = 728.

2. 301
Reasoning 9 ÷ 3: write 3, subtract 9, remainder 0; bring down the next digit: 0 ÷ 3: write 0, subtract 0, remainder 0; bring down the next digit: 3 ÷ 3: write 1, subtract 3, remainder 0. Check: 3 × 301 = 903.

3. 105
Reasoning 4 ÷ 4: write 1, subtract 4, remainder 0; bring down the next digit: 2 ÷ 4: write 0, subtract 0, remainder 2; bring down the next digit: 20 ÷ 4: write 5, subtract 20, remainder 0. Check: 4 × 105 = 420.

4. 401
Reasoning 72 ÷ 18: write 4, subtract 72, remainder 0; bring down the next digit: 1 ÷ 18: write 0, subtract 0, remainder 1; bring down the next digit: 18 ÷ 18: write 1, subtract 18, remainder 0. Check: 18 × 401 = 7218.

5. 108
Reasoning 24 ÷ 23: write 1, subtract 23, remainder 1; bring down the next digit: 18 ÷ 23: write 0, subtract 0, remainder 18; bring down the next digit: 184 ÷ 23: write 8, subtract 184, remainder 0. Check: 23 × 108 = 2484.

6. 109
Reasoning 17 ÷ 16: write 1, subtract 16, remainder 1; bring down the next digit: 14 ÷ 16: write 0, subtract 0, remainder 14; bring down the next digit: 144 ÷ 16: write 9, subtract 144, remainder 0. Check: 16 × 109 = 1744.

7. 305 R 21
Reasoning 106 ÷ 35: write 3, subtract 105, remainder 1; bring down the next digit: 19 ÷ 35: write 0, subtract 0, remainder 19; bring down the next digit: 196 ÷ 35: write 5, subtract 175, remainder 21. Check: 35 × 305 + 21 = 10696.

8. 105 R 1
Reasoning 23 ÷ 22: write 1, subtract 22, remainder 1; bring down the next digit: 11 ÷ 22: write 0, subtract 0, remainder 11; bring down the next digit: 111 ÷ 22: write 5, subtract 110, remainder 1. Check: 22 × 105 + 1 = 2311.

9. 206 full packets; 13 cards remain
Reasoning 4751 = 23 × 206 + 13.

10. 307 full packets; 13 cards remain
Reasoning 9530 = 31 × 307 + 13.

Adding Decimals

Whole Numbers and Decimals

1. 80.9
Reasoning Align decimal points; 76.1 + 4.8 = 80.9.

2. 67.5
Reasoning Align decimal points; 63.1 + 4.4 = 67.5.

3. 89.6
Reasoning Align decimal points; 82.5 + 7.1 = 89.6.

4. 7.3
Reasoning Align decimal points; 3 + 4.3 = 7.3.

5. 9.56
Reasoning Align decimal points; 5.86 + 3.7 = 9.56.

6. 15.81
Reasoning Align decimal points; 7.01 + 8.8 = 15.81.

7. 9.63
Reasoning Align decimal points; 8.94 + 0.69 = 9.63.

8. 7.2
Reasoning Align decimal points; 6.68 + 0.52 = 7.2.

9. 9.18 km
Reasoning Align decimal points; 8.36 + 0.82 = 9.18.

10. 6.06 km
Reasoning Align decimal points; 5.45 + 0.61 = 6.06.

Subtracting Decimals

Whole Numbers and Decimals

1. 57.3
Reasoning Align decimal points; 65.1 - 7.8 = 57.3.

2. 77.8
Reasoning Align decimal points; 83.1 - 5.3 = 77.8.

3. 19.5
Reasoning Align decimal points; 21 - 1.5 = 19.5.

4. 2.23
Reasoning Align decimal points; 6 - 3.77 = 2.23.

5. 1.53
Reasoning Align decimal points; 8.13 - 6.6 = 1.53.

6. 0.95
Reasoning Align decimal points; 4.25 - 3.3 = 0.95.

7. 2.83
Reasoning Align decimal points; 3.27 - 0.44 = 2.83.

8. 8.27
Reasoning Align decimal points; 9.14 - 0.87 = 8.27.

9. 7.7 L
Reasoning Align decimal points; 7.85 - 0.15 = 7.7.

10. 3.94 L
Reasoning Align decimal points; 4.73 - 0.79 = 3.94.

Quiz 1

Whole Numbers and Decimals

1. 24
Reasoning 12 ÷ 5: write 2, subtract 10, remainder 2; bring down the next digit: 20 ÷ 5: write 4, subtract 20, remainder 0. Check: 5 × 24 = 120.

2. 244
Reasoning 82 ÷ 34: write 2, subtract 68, remainder 14; bring down the next digit: 149 ÷ 34: write 4, subtract 136, remainder 13; bring down the next digit: 136 ÷ 34: write 4, subtract 136, remainder 0. Check: 34 × 244 = 8296.

3. 307
Reasoning 42 ÷ 14: write 3, subtract 42, remainder 0; bring down the next digit: 9 ÷ 14: write 0, subtract 0, remainder 9; bring down the next digit: 98 ÷ 14: write 7, subtract 98, remainder 0. Check: 14 × 307 = 4298.

4. 4.09
Reasoning Align decimal points; 3.39 + 0.7 = 4.09.

5. 1.16 L
Reasoning Align decimal points; 1.59 - 0.43 = 1.16.

Multiplying Decimals

Whole Numbers and Decimals

1. 206.44
Reasoning Compute the whole-number product and restore decimal places: 39.7 × 5.2 = 206.44.

2. 114.66
Reasoning Compute the whole-number product and restore decimal places: 29.4 × 3.9 = 114.66.

3. 88.92
Reasoning Compute the whole-number product and restore decimal places: 68.4 × 1.3 = 88.92.

4. 25.272
Reasoning Compute the whole-number product and restore decimal places: 4.86 × 5.2 = 25.272.

5. 13.65
Reasoning Compute the whole-number product and restore decimal places: 3.5 × 3.9 = 13.65.

6. 18.753
Reasoning Compute the whole-number product and restore decimal places: 8.93 × 2.1 = 18.753.

7. 0.6604
Reasoning Compute the whole-number product and restore decimal places: 2.54 × 0.26 = 0.6604.

8. 1.5729
Reasoning Compute the whole-number product and restore decimal places: 7.49 × 0.21 = 1.5729.

9. 3.6516 dollars
Reasoning Compute the whole-number product and restore decimal places: 7.16 × 0.51 = 3.6516.

10. 0.71 dollars
Reasoning Compute the whole-number product and restore decimal places: 1.42 × 0.5 = 0.71.

Decimal Products in Context

Whole Numbers and Decimals

1. 385.71
Reasoning Compute the whole-number product and restore decimal places: 89.7 × 4.3 = 385.71.

2. 55.68
Reasoning Compute the whole-number product and restore decimal places: 46.4 × 1.2 = 55.68.

3. 79.2
Reasoning Compute the whole-number product and restore decimal places: 22 × 3.6 = 79.2.

4. 7.005
Reasoning Compute the whole-number product and restore decimal places: 4.67 × 1.5 = 7.005.

5. 29.281
Reasoning Compute the whole-number product and restore decimal places: 6.23 × 4.7 = 29.281.

6. 8.788
Reasoning Compute the whole-number product and restore decimal places: 3.38 × 2.6 = 8.788.

7. 1.0478
Reasoning Compute the whole-number product and restore decimal places: 4.03 × 0.26 = 1.0478.

8. 1.224
Reasoning Compute the whole-number product and restore decimal places: 1.7 × 0.72 = 1.224.

9. 4.1391 dollars
Reasoning Compute the whole-number product and restore decimal places: 5.67 × 0.73 = 4.1391.

10. 3.42 dollars
Reasoning Compute the whole-number product and restore decimal places: 5.7 × 0.6 = 3.42.

Dividing by Decimals

Whole Numbers and Decimals

1. 27
Reasoning Multiply both numbers by 10: 81 ÷ 3 = 27. Check: 0.3 × 27 = 8.1.

2. 75
Reasoning Multiply both numbers by 10: 600 ÷ 8 = 75. Check: 0.8 × 75 = 60.

3. 30
Reasoning Multiply both numbers by 10: 210 ÷ 7 = 30. Check: 0.7 × 30 = 21.

4. 7.6
Reasoning Multiply both numbers by 10: 182.4 ÷ 24 = 7.6. Check: 2.4 × 7.6 = 18.24.

5. 5.3
Reasoning Multiply both numbers by 10: 127.2 ÷ 24 = 5.3. Check: 2.4 × 5.3 = 12.72.

6. 7.4
Reasoning Multiply both numbers by 10: 473.6 ÷ 64 = 7.4. Check: 6.4 × 7.4 = 47.36.

7. 1.9
Reasoning Multiply both numbers by 100: 60.8 ÷ 32 = 1.9. Check: 0.32 × 1.9 = 0.608.

8. 2
Reasoning Multiply both numbers by 100: 64 ÷ 32 = 2. Check: 0.32 × 2 = 0.64.

9. 2.9 bags
Reasoning Multiply both numbers by 100: 92.8 ÷ 32 = 2.9. Check: 0.32 × 2.9 = 0.928.

10. 8.4 bags
Reasoning Multiply both numbers by 100: 201.6 ÷ 24 = 8.4. Check: 0.24 × 8.4 = 2.016.

Decimal Quotients and Checks

Whole Numbers and Decimals

1. 45
Reasoning Multiply both numbers by 10: 405 ÷ 9 = 45. Check: 0.9 × 45 = 40.5.

2. 67
Reasoning Multiply both numbers by 10: 201 ÷ 3 = 67. Check: 0.3 × 67 = 20.1.

3. 79
Reasoning Multiply both numbers by 10: 237 ÷ 3 = 79. Check: 0.3 × 79 = 23.7.

4. 4
Reasoning Multiply both numbers by 10: 100 ÷ 25 = 4. Check: 2.5 × 4 = 10.

5. 5.7
Reasoning Multiply both numbers by 10: 136.8 ÷ 24 = 5.7. Check: 2.4 × 5.7 = 13.68.

6. 2.5
Reasoning Multiply both numbers by 10: 60 ÷ 24 = 2.5. Check: 2.4 × 2.5 = 6.

7. 5.5
Reasoning Multiply both numbers by 100: 82.5 ÷ 15 = 5.5. Check: 0.15 × 5.5 = 0.825.

8. 3.2
Reasoning Multiply both numbers by 100: 80 ÷ 25 = 3.2. Check: 0.25 × 3.2 = 0.8.

9. 3.7 bags
Reasoning Multiply both numbers by 100: 236.8 ÷ 64 = 3.7. Check: 0.64 × 3.7 = 2.368.

10. 3.2 bags
Reasoning Multiply both numbers by 100: 76.8 ÷ 24 = 3.2. Check: 0.24 × 3.2 = 0.768.

Quiz 2

Whole Numbers and Decimals

1. 28
Reasoning 8 ÷ 3: write 2, subtract 6, remainder 2; bring down the next digit: 24 ÷ 3: write 8, subtract 24, remainder 0. Check: 3 × 28 = 84.

2. 26.402
Reasoning Compute the whole-number product and restore decimal places: 3.07 × 8.6 = 26.402.

3. 5.371
Reasoning Compute the whole-number product and restore decimal places: 1.31 × 4.1 = 5.371.

4. 8
Reasoning Multiply both numbers by 10: 32 ÷ 4 = 8. Check: 0.4 × 8 = 3.2.

5. 5.3 bags
Reasoning Multiply both numbers by 100: 79.5 ÷ 15 = 5.3. Check: 0.15 × 5.3 = 0.795.

Greatest Common Factors

Whole Numbers and Decimals

1. 4
Reasoning Common factors: 1, 2, 4; greatest is 4.

2. 4
Reasoning Common factors: 1, 2, 4; greatest is 4.

3. 5
Reasoning Common factors: 1, 5; greatest is 5.

4. 15
Reasoning Common factors: 1, 3, 5, 15; greatest is 15.

5. 12
Reasoning Common factors: 1, 2, 3, 4, 6, 12; greatest is 12.

6. 6
Reasoning Common factors: 1, 2, 3, 6; greatest is 6.

7. 12 kits; 5 pencils and 7 erasers each
Reasoning GCF(60, 84) = 12; divide both counts by 12.

8. 24 kits; 2 pencils and 3 erasers each
Reasoning GCF(48, 72) = 24; divide both counts by 24.

9. 10 kits; 7 pencils and 10 erasers each
Reasoning GCF(70, 100) = 10; divide both counts by 10.

10. 6 kits; 2 pencils and 3 erasers each
Reasoning GCF(12, 18) = 6; divide both counts by 6.

Least Common Multiples

Whole Numbers and Decimals

1. 12
Reasoning The first positive multiple shared by 4 and 3 is 12.

2. 12
Reasoning The first positive multiple shared by 4 and 6 is 12.

3. 20
Reasoning The first positive multiple shared by 5 and 4 is 20.

4. 99
Reasoning The first positive multiple shared by 9 and 11 is 99.

5. 6
Reasoning The first positive multiple shared by 6 and 3 is 6.

6. 40
Reasoning The first positive multiple shared by 10 and 8 is 40.

7. 6 seconds
Reasoning The first positive multiple shared by 2 and 3 is 6.

8. 132 seconds
Reasoning The first positive multiple shared by 11 and 12 is 132.

9. 15 seconds
Reasoning The first positive multiple shared by 3 and 5 is 15.

10. 20 seconds
Reasoning The first positive multiple shared by 4 and 10 is 20.

Factoring Sums

Whole Numbers and Decimals

1. 3(2 + 3)
Reasoning GCF = 3; 6 = 3 × 2 and 9 = 3 × 3.

2. 4(2 + 3)
Reasoning GCF = 4; 8 = 4 × 2 and 12 = 4 × 3.

3. 5(2 + 3)
Reasoning GCF = 5; 10 = 5 × 2 and 15 = 5 × 3.

4. 6(3 + 5)
Reasoning GCF = 6; 18 = 6 × 3 and 30 = 6 × 5.

5. 15(3 + 4)
Reasoning GCF = 15; 45 = 15 × 3 and 60 = 15 × 4.

6. 6(2 + 3)
Reasoning GCF = 6; 12 = 6 × 2 and 18 = 6 × 3.

7. 24(2 + 3)
Reasoning GCF = 24; 48 = 24 × 2 and 72 = 24 × 3.

8. 12(2 + 3)
Reasoning GCF = 12; 24 = 12 × 2 and 36 = 12 × 3.

9. 12(5 + 7)
Reasoning GCF = 12; 60 = 12 × 5 and 84 = 12 × 7.

10. 10(7 + 10)
Reasoning GCF = 10; 70 = 10 × 7 and 100 = 10 × 10.

Division with Remainders in Context

Whole Numbers and Decimals

1. 75
Reasoning 45 ÷ 6: write 7, subtract 42, remainder 3; bring down the next digit: 30 ÷ 6: write 5, subtract 30, remainder 0. Check: 6 × 75 = 450.

2. 88
Reasoning 26 ÷ 3: write 8, subtract 24, remainder 2; bring down the next digit: 24 ÷ 3: write 8, subtract 24, remainder 0. Check: 3 × 88 = 264.

3. 40
Reasoning 24 ÷ 6: write 4, subtract 24, remainder 0; bring down the next digit: 0 ÷ 6: write 0, subtract 0, remainder 0. Check: 6 × 40 = 240.

4. 184
Reasoning 38 ÷ 21: write 1, subtract 21, remainder 17; bring down the next digit: 176 ÷ 21: write 8, subtract 168, remainder 8; bring down the next digit: 84 ÷ 21: write 4, subtract 84, remainder 0. Check: 21 × 184 = 3864.

5. 162
Reasoning 56 ÷ 35: write 1, subtract 35, remainder 21; bring down the next digit: 217 ÷ 35: write 6, subtract 210, remainder 7; bring down the next digit: 70 ÷ 35: write 2, subtract 70, remainder 0. Check: 35 × 162 = 5670.

6. 300
Reasoning 96 ÷ 32: write 3, subtract 96, remainder 0; bring down the next digit: 0 ÷ 32: write 0, subtract 0, remainder 0; bring down the next digit: 0 ÷ 32: write 0, subtract 0, remainder 0. Check: 32 × 300 = 9600.

7. 400 R 23
Reasoning 156 ÷ 39: write 4, subtract 156, remainder 0; bring down the next digit: 2 ÷ 39: write 0, subtract 0, remainder 2; bring down the next digit: 23 ÷ 39: write 0, subtract 0, remainder 23. Check: 39 × 400 + 23 = 15623.

8. 178 R 18
Reasoning 62 ÷ 35: write 1, subtract 35, remainder 27; bring down the next digit: 274 ÷ 35: write 7, subtract 245, remainder 29; bring down the next digit: 298 ÷ 35: write 8, subtract 280, remainder 18. Check: 35 × 178 + 18 = 6248.

9. 236 full packets; 2 cards remain
Reasoning 7318 = 31 × 236 + 2.

10. 339 full packets; 2 cards remain
Reasoning 5087 = 15 × 339 + 2.

Unit 1 Test

Whole Numbers and Decimals

1. 80
Reasoning 32 ÷ 4: write 8, subtract 32, remainder 0; bring down the next digit: 0 ÷ 4: write 0, subtract 0, remainder 0. Check: 4 × 80 = 320.

2. 90.6
Reasoning Align decimal points; 86 + 4.6 = 90.6.

3. 90.7
Reasoning Align decimal points; 93.4 - 2.7 = 90.7.

4. 1
Reasoning 2 × 1/2 = 1.

5. 75
Reasoning 37 ÷ 5: write 7, subtract 35, remainder 2; bring down the next digit: 25 ÷ 5: write 5, subtract 25, remainder 0. Check: 5 × 75 = 375.

6. 102
Reasoning 7 ÷ 7: write 1, subtract 7, remainder 0; bring down the next digit: 1 ÷ 7: write 0, subtract 0, remainder 1; bring down the next digit: 14 ÷ 7: write 2, subtract 14, remainder 0. Check: 7 × 102 = 714.

7. 18.2
Reasoning Align decimal points; 17 + 1.2 = 18.2.

8. 5.05
Reasoning Align decimal points; 8.05 - 3 = 5.05.

9. 9.906
Reasoning Compute the whole-number product and restore decimal places: 7.62 × 1.3 = 9.906.

10. 39.788
Reasoning Compute the whole-number product and restore decimal places: 6.86 × 5.8 = 39.788.

11. 4.3
Reasoning Multiply both numbers by 10: 103.2 ÷ 24 = 4.3. Check: 2.4 × 4.3 = 10.32.

12. 8.3
Reasoning Multiply both numbers by 10: 265.6 ÷ 32 = 8.3. Check: 3.2 × 8.3 = 26.56.

13. 12
Reasoning Common factors: 1, 2, 3, 4, 6, 12; greatest is 12.

14. 12 seconds
Reasoning The first positive multiple shared by 2 and 12 is 12.

15. 14(2 + 3)
Reasoning GCF = 14; 28 = 14 × 2 and 42 = 14 × 3.

16. 381 R 11
Reasoning 49 ÷ 13: write 3, subtract 39, remainder 10; bring down the next digit: 106 ÷ 13: write 8, subtract 104, remainder 2; bring down the next digit: 24 ÷ 13: write 1, subtract 13, remainder 11. Check: 13 × 381 + 11 = 4964.

17. 332 R 1
Reasoning 83 ÷ 25: write 3, subtract 75, remainder 8; bring down the next digit: 80 ÷ 25: write 3, subtract 75, remainder 5; bring down the next digit: 51 ÷ 25: write 2, subtract 50, remainder 1. Check: 25 × 332 + 1 = 8301.

18. 105 full packets; 3 cards remain
Reasoning 1683 = 16 × 105 + 3.

19. 6.07 km
Reasoning Align decimal points; 5.56 + 0.51 = 6.07.

20. 3.51 L
Reasoning Align decimal points; 4.04 - 0.53 = 3.51.

Fraction Products as Preparation

Fraction Operations and Models

1. 1/4
Reasoning 1/2 × 1/2 = 1/4.

2. 1/4
Reasoning 1 × 1/4 = 1/4.

3. 3/8
Reasoning 3/4 × 1/2 = 3/8.

4. 1/8
Reasoning 1 × 1/8 = 1/8.

5. 2/3
Reasoning 1 × 2/3 = 2/3.

6. 3/8
Reasoning 3/5 × 5/8 = 3/8.

7. 2/15
Reasoning 2/3 × 1/5 = 2/15.

8. 1/10
Reasoning 1/2 × 1/5 = 1/10.

9. 8/3
Reasoning 8/3 × 1 = 8/3.

10. 10/3
Reasoning 4/3 × 5/2 = 10/3.

Mixed Number Products

Fraction Operations and Models

1. 55/16
Reasoning 11/4 × 5/4 = 55/16.

2. 81/16
Reasoning 9/4 × 9/4 = 81/16.

3. 117/16
Reasoning 13/4 × 9/4 = 117/16.

4. 25/4
Reasoning 5/2 × 5/2 = 25/4.

5. 35/6
Reasoning 5/2 × 7/3 = 35/6.

6. 63/16
Reasoning 7/4 × 9/4 = 63/16.

7. 77/12
Reasoning 11/4 × 7/3 = 77/12.

8. 39/8
Reasoning 13/4 × 3/2 = 39/8.

9. 45/8
Reasoning 15/4 × 3/2 = 45/8.

10. 35/8
Reasoning 7/4 × 5/2 = 35/8.

Equal Groups in Fraction Bars

Fraction Operations and Models

1. 1
Reasoning Each small part is 1/6; 3 shaded parts divided into groups of 3 gives 3/3 = 1 groups.

2. 1
Reasoning Each small part is 1/8; 3 shaded parts divided into groups of 3 gives 3/3 = 1 groups.

3. 7/2
Reasoning Each small part is 1/12; 7 shaded parts divided into groups of 2 gives 7/2 = 7/2 groups.

4. 7/4
Reasoning Each small part is 1/10; 7 shaded parts divided into groups of 4 gives 7/4 = 7/4 groups.

5. 4/3
Reasoning Each small part is 1/10; 4 shaded parts divided into groups of 3 gives 4/3 = 4/3 groups.

6. 1
Reasoning Each small part is 1/10; 5 shaded parts divided into groups of 5 gives 5/5 = 1 groups.

7. 1
Reasoning Each small part is 1/10; 5 shaded parts divided into groups of 5 gives 5/5 = 1 groups.

8. 3
Reasoning Each small part is 1/10; 6 shaded parts divided into groups of 2 gives 6/2 = 3 groups.

9. 7/6
Reasoning Each small part is 1/8; 7 shaded parts divided into groups of 6 gives 7/6 = 7/6 groups.

10. 9/7
Reasoning Each small part is 1/12; 9 shaded parts divided into groups of 7 gives 9/7 = 9/7 groups.

Partial Groups in Fraction Bars

Fraction Operations and Models

1. 2
Reasoning Each small part is 1/6; 6 shaded parts divided into groups of 3 gives 6/3 = 2 groups.

2. 8/3
Reasoning Each small part is 1/10; 8 shaded parts divided into groups of 3 gives 8/3 = 8/3 groups.

3. 7/3
Reasoning Each small part is 1/10; 7 shaded parts divided into groups of 3 gives 7/3 = 7/3 groups.

4. 2
Reasoning Each small part is 1/8; 8 shaded parts divided into groups of 4 gives 8/4 = 2 groups.

5. 2
Reasoning Each small part is 1/8; 2 shaded parts divided into groups of 1 gives 2/1 = 2 groups.

6. 3/2
Reasoning Each small part is 1/6; 3 shaded parts divided into groups of 2 gives 3/2 = 3/2 groups.

7. 1
Reasoning Each small part is 1/6; 3 shaded parts divided into groups of 3 gives 3/3 = 1 groups.

8. 1
Reasoning Each small part is 1/8; 2 shaded parts divided into groups of 2 gives 2/2 = 1 groups.

9. 2
Reasoning Each small part is 1/10; 4 shaded parts divided into groups of 2 gives 4/2 = 2 groups.

10. 1
Reasoning Each small part is 1/8; 8 shaded parts divided into groups of 8 gives 8/8 = 1 groups.

Quiz 1

Fraction Operations and Models

1. 206
Reasoning 14 ÷ 7: write 2, subtract 14, remainder 0; bring down the next digit: 4 ÷ 7: write 0, subtract 0, remainder 4; bring down the next digit: 42 ÷ 7: write 6, subtract 42, remainder 0. Check: 7 × 206 = 1442.

2. 9/8
Reasoning 3/2 × 3/4 = 9/8.

3. 65/16
Reasoning 13/4 × 5/4 = 65/16.

4. 7/3
Reasoning Each small part is 1/10; 7 shaded parts divided into groups of 3 gives 7/3 = 7/3 groups.

5. 2
Reasoning Each small part is 1/4; 4 shaded parts divided into groups of 2 gives 4/2 = 2 groups.

Fraction Division and Reciprocals

Fraction Operations and Models

1. 3
Reasoning 3/4 ÷ 1/4 = 3/4 × 4 = 3.

2. 1/2
Reasoning 1/4 ÷ 1/2 = 1/4 × 2 = 1/2.

3. 3/2
Reasoning 3/4 ÷ 1/2 = 3/4 × 2 = 3/2.

4. 3/5
Reasoning 6/5 ÷ 2 = 6/5 × 1/2 = 3/5.

5. 8/5
Reasoning 2 ÷ 5/4 = 2 × 4/5 = 8/5.

6. 10/3
Reasoning 5/3 ÷ 1/2 = 5/3 × 2 = 10/3.

7. 1
Reasoning 1 ÷ 1 = 1 × 1 = 1.

8. 1/3
Reasoning 1/6 ÷ 1/2 = 1/6 × 2 = 1/3.

9. 2/5
Reasoning 1/5 ÷ 1/2 = 1/5 × 2 = 2/5.

10. 2/25
Reasoning 1/5 ÷ 5/2 = 1/5 × 2/5 = 2/25.

Checking Fraction Quotients

Fraction Operations and Models

1. 4
Reasoning 1 ÷ 1/4 = 1 × 4 = 4.

2. 1
Reasoning 1/2 ÷ 1/2 = 1/2 × 2 = 1.

3. 1
Reasoning 1/4 ÷ 1/4 = 1/4 × 4 = 1.

4. 15/2
Reasoning 3/2 ÷ 1/5 = 3/2 × 5 = 15/2.

5. 1/3
Reasoning 1/3 ÷ 1 = 1/3 × 1 = 1/3.

6. 16/15
Reasoning 2/3 ÷ 5/8 = 2/3 × 8/5 = 16/15.

7. 3/4
Reasoning 3/8 ÷ 1/2 = 3/8 × 2 = 3/4.

8. 2/3
Reasoning 2/3 ÷ 1 = 2/3 × 1 = 2/3.

9. 6
Reasoning 3/4 ÷ 1/8 = 3/4 × 8 = 6.

10. 2
Reasoning 2 ÷ 1 = 2 × 1 = 2.

Dividing Mixed Numbers

Fraction Operations and Models

1. 9/2
Reasoning 9/4 ÷ 1/2 = 9/4 × 2 = 9/2.

2. 6
Reasoning 3 ÷ 1/2 = 3 × 2 = 6.

3. 12
Reasoning 3 ÷ 1/4 = 3 × 4 = 12.

4. 13/10
Reasoning 13/5 ÷ 2 = 13/5 × 1/2 = 13/10.

5. 12/5
Reasoning 3 ÷ 5/4 = 3 × 4/5 = 12/5.

6. 56/33
Reasoning 14/3 ÷ 11/4 = 14/3 × 4/11 = 56/33.

7. 8/9
Reasoning 8/3 ÷ 3 = 8/3 × 1/3 = 8/9.

8. 33/20
Reasoning 11/4 ÷ 5/3 = 11/4 × 3/5 = 33/20.

9. 20/21
Reasoning 5/2 ÷ 21/8 = 5/2 × 8/21 = 20/21.

10. 7/4
Reasoning 7/2 ÷ 2 = 7/2 × 1/2 = 7/4.

Mixed Number Quotients and Checks

Fraction Operations and Models

1. 7/2
Reasoning 7/4 ÷ 1/2 = 7/4 × 2 = 7/2.

2. 11/2
Reasoning 11/4 ÷ 1/2 = 11/4 × 2 = 11/2.

3. 5
Reasoning 5/4 ÷ 1/4 = 5/4 × 4 = 5.

4. 15/14
Reasoning 15/4 ÷ 7/2 = 15/4 × 2/7 = 15/14.

5. 30/17
Reasoning 15/4 ÷ 17/8 = 15/4 × 8/17 = 30/17.

6. 1
Reasoning 3/2 ÷ 3/2 = 3/2 × 2/3 = 1.

7. 7/8
Reasoning 7/2 ÷ 4 = 7/2 × 1/4 = 7/8.

8. 8/5
Reasoning 4 ÷ 5/2 = 4 × 2/5 = 8/5.

9. 6/5
Reasoning 9/5 ÷ 3/2 = 9/5 × 2/3 = 6/5.

10. 4/3
Reasoning 3 ÷ 9/4 = 3 × 4/9 = 4/3.

Quiz 2

Fraction Operations and Models

1. 38
Reasoning Multiply both numbers by 10: 114 ÷ 3 = 38. Check: 0.3 × 38 = 11.4.

2. 2
Reasoning 1 ÷ 1/2 = 1 × 2 = 2.

3. 4/3
Reasoning 4/3 ÷ 1 = 4/3 × 1 = 4/3.

4. 88/45
Reasoning 22/5 ÷ 9/4 = 22/5 × 4/9 = 88/45.

5. 16/5
Reasoning 4 ÷ 5/4 = 4 × 4/5 = 16/5.

Interpreting Fraction Division Stories

Fraction Operations and Models

1. 1/2 piece-lengths
Reasoning 1/4 ÷ 1/2 = 1/4 × 2 = 1/2.

2. 1 piece-lengths
Reasoning 1/4 ÷ 1/4 = 1/4 × 4 = 1.

3. 4 piece-lengths
Reasoning 1 ÷ 1/4 = 1 × 4 = 4.

4. 5/9 piece-lengths
Reasoning 1/3 ÷ 3/5 = 1/3 × 5/3 = 5/9.

5. 21/32 piece-lengths
Reasoning 7/8 ÷ 4/3 = 7/8 × 3/4 = 21/32.

6. 15/16 piece-lengths
Reasoning 5/4 ÷ 4/3 = 5/4 × 3/4 = 15/16.

7. 1 bottles; 0 L left
Reasoning 1 ÷ 1 = 1 × 1 = 1. Only whole bottles count; subtract the liquid used.

8. 0 bottles; 1/3 L left
Reasoning 1/3 ÷ 3/2 = 1/3 × 2/3 = 2/9. Only whole bottles count; subtract the liquid used.

9. 0 bottles; 3/5 L left
Reasoning 3/5 ÷ 1 = 3/5 × 1 = 3/5. Only whole bottles count; subtract the liquid used.

10. 1 bottles; 0 L left
Reasoning 5/2 ÷ 5/2 = 5/2 × 2/5 = 1. Only whole bottles count; subtract the liquid used.

Full Containers and Leftovers

Fraction Operations and Models

1. 1 piece-lengths
Reasoning 1/2 ÷ 1/2 = 1/2 × 2 = 1.

2. 2 piece-lengths
Reasoning 1 ÷ 1/2 = 1 × 2 = 2.

3. 3/2 piece-lengths
Reasoning 3/4 ÷ 1/2 = 3/4 × 2 = 3/2.

4. 3/2 piece-lengths
Reasoning 3/2 ÷ 1 = 3/2 × 1 = 3/2.

5. 4/5 piece-lengths
Reasoning 6/5 ÷ 3/2 = 6/5 × 2/3 = 4/5.

6. 8/3 piece-lengths
Reasoning 4/3 ÷ 1/2 = 4/3 × 2 = 8/3.

7. 2 bottles; 0 L left
Reasoning 2 ÷ 1 = 2 × 1 = 2. Only whole bottles count; subtract the liquid used.

8. 0 bottles; 1/4 L left
Reasoning 1/4 ÷ 2/5 = 1/4 × 5/2 = 5/8. Only whole bottles count; subtract the liquid used.

9. 2 bottles; 0 L left
Reasoning 1 ÷ 1/2 = 1 × 2 = 2. Only whole bottles count; subtract the liquid used.

10. 4 bottles; 0 L left
Reasoning 3/2 ÷ 3/8 = 3/2 × 8/3 = 4. Only whole bottles count; subtract the liquid used.

Missing Factors and Quotients

Fraction Operations and Models

1. n = 1; 1/4 ÷ 1/4 = 1
Reasoning 1/4 ÷ 1/4 = 1/4 × 4 = 1. Check: 1/4 × 1 = 1/4.

2. n = 3; 3/4 ÷ 1/4 = 3
Reasoning 3/4 ÷ 1/4 = 3/4 × 4 = 3. Check: 1/4 × 3 = 3/4.

3. n = 2; 1/2 ÷ 1/4 = 2
Reasoning 1/2 ÷ 1/4 = 1/2 × 4 = 2. Check: 1/4 × 2 = 1/2.

4. n = 2; 3 ÷ 3/2 = 2
Reasoning 3 ÷ 3/2 = 3 × 2/3 = 2. Check: 3/2 × 2 = 3.

5. n = 7/6; 7/8 ÷ 3/4 = 7/6
Reasoning 7/8 ÷ 3/4 = 7/8 × 4/3 = 7/6. Check: 3/4 × 7/6 = 7/8.

6. n = 16/15; 8/3 ÷ 5/2 = 16/15
Reasoning 8/3 ÷ 5/2 = 8/3 × 2/5 = 16/15. Check: 5/2 × 16/15 = 8/3.

7. n = 3; 3/5 ÷ 1/5 = 3
Reasoning 3/5 ÷ 1/5 = 3/5 × 5 = 3. Check: 1/5 × 3 = 3/5.

8. n = 12/5; 3/5 ÷ 1/4 = 12/5
Reasoning 3/5 ÷ 1/4 = 3/5 × 4 = 12/5. Check: 1/4 × 12/5 = 3/5.

9. n = 1/8; 1/8 ÷ 1 = 1/8
Reasoning 1/8 ÷ 1 = 1/8 × 1 = 1/8. Check: 1 × 1/8 = 1/8.

10. n = 1/4; 1/8 ÷ 1/2 = 1/4
Reasoning 1/8 ÷ 1/2 = 1/8 × 2 = 1/4. Check: 1/2 × 1/4 = 1/8.

Explaining Fraction Division

Fraction Operations and Models

1. 2
Reasoning 1/2 ÷ 1/4 = 1/2 × 4 = 2.

2. 2
Reasoning 1 ÷ 1/2 = 1 × 2 = 2.

3. 1
Reasoning 1/2 ÷ 1/2 = 1/2 × 2 = 1.

4. 7/6
Reasoning 7/6 ÷ 1 = 7/6 × 1 = 7/6.

5. 1
Reasoning 2 ÷ 2 = 2 × 1/2 = 1.

6. 1/4
Reasoning 3/8 ÷ 3/2 = 3/8 × 2/3 = 1/4.

7. 8/5
Reasoning 2/5 ÷ 1/4 = 2/5 × 4 = 8/5.

8. 8/3
Reasoning 4/3 ÷ 1/2 = 4/3 × 2 = 8/3.

9. 3/8
Reasoning 1/2 ÷ 4/3 = 1/2 × 3/4 = 3/8.

10. 10
Reasoning 2 ÷ 1/5 = 2 × 5 = 10.

Unit 2 Test

Fraction Operations and Models

1. 62.6
Reasoning Align decimal points; 57.2 + 5.4 = 62.6.

2. 212.42
Reasoning Compute the whole-number product and restore decimal places: 24.7 × 8.6 = 212.42.

3. 3
Reasoning Common factors: 1, 3; greatest is 3.

4. 145
Reasoning 31 ÷ 22: write 1, subtract 22, remainder 9; bring down the next digit: 99 ÷ 22: write 4, subtract 88, remainder 11; bring down the next digit: 110 ÷ 22: write 5, subtract 110, remainder 0. Check: 22 × 145 = 3190.

5. 3/16
Reasoning 3/4 × 1/4 = 3/16.

6. 9/4
Reasoning 3/2 × 3/2 = 9/4.

7. 11/10
Reasoning Each small part is 1/12; 11 shaded parts divided into groups of 10 gives 11/10 = 11/10 groups.

8. 1
Reasoning Each small part is 1/4; 2 shaded parts divided into groups of 2 gives 2/2 = 1 groups.

9. 7/12
Reasoning 7/8 ÷ 3/2 = 7/8 × 2/3 = 7/12.

10. 2/5
Reasoning 1/2 ÷ 5/4 = 1/2 × 4/5 = 2/5.

11. 9/5
Reasoning 3 ÷ 5/3 = 3 × 3/5 = 9/5.

12. 20/9
Reasoning 5 ÷ 9/4 = 5 × 4/9 = 20/9.

13. 1 piece-lengths
Reasoning 2 ÷ 2 = 2 × 1/2 = 1.

14. 0 bottles; 1/3 L left
Reasoning 1/3 ÷ 4/5 = 1/3 × 5/4 = 5/12. Only whole bottles count; subtract the liquid used.

15. n = 7/8; 7/8 ÷ 1 = 7/8
Reasoning 7/8 ÷ 1 = 7/8 × 1 = 7/8. Check: 1 × 7/8 = 7/8.

16. 3/2
Reasoning 1/2 ÷ 1/3 = 1/2 × 3 = 3/2.

17. 5/16
Reasoning 5/8 × 1/2 = 5/16.

18. 15/4
Reasoning 3/2 × 5/2 = 15/4.

19. 3/2
Reasoning Each small part is 1/6; 3 shaded parts divided into groups of 2 gives 3/2 = 3/2 groups.

20. 4
Reasoning Each small part is 1/4; 4 shaded parts divided into groups of 1 gives 4/1 = 4 groups.

Ratio Language and Order

Ratios and Measurement

1. 2:5
Reasoning Keep red first; divide 2:5 by 1.

2. 7:3
Reasoning Keep red first; divide 7:3 by 1.

3. 1:3
Reasoning Keep red first; divide 2:6 by 2.

4. 2:5
Reasoning Keep red first; divide 10:25 by 5.

5. 5:6
Reasoning Keep red first; divide 20:24 by 4.

6. 7:2
Reasoning Keep red first; divide 14:4 by 2.

7. 3:2; 3/2 times as many
Reasoning Keep red first; divide 18:12 by 6.

8. 8:3; 8/3 times as many
Reasoning Keep red first; divide 16:6 by 2.

9. 8:7; 8/7 times as many
Reasoning Keep red first; divide 40:35 by 5.

10. 1:2; 1/2 times as many
Reasoning Keep red first; divide 12:24 by 12.

Parts and the Whole

Ratios and Measurement

1. 5/8
Reasoning Total = 40; green fraction = 25/40 = 5/8.

2. 4/9
Reasoning Total = 18; green fraction = 8/18 = 4/9.

3. 2/5
Reasoning Total = 30; green fraction = 12/30 = 2/5.

4. 5/12
Reasoning Total = 24; green fraction = 10/24 = 5/12.

5. 3/8
Reasoning Total = 32; green fraction = 12/32 = 3/8.

6. 7/13
Reasoning Total = 65; green fraction = 35/65 = 7/13.

7. 3/7; 3/4 or 3:4; the whole includes both colors
Reasoning Total = 35; green fraction = 15/35 = 3/7.

8. 5/12; 5/7 or 5:7; the whole includes both colors
Reasoning Total = 36; green fraction = 15/36 = 5/12.

9. 4/11; 4/7 or 4:7; the whole includes both colors
Reasoning Total = 55; green fraction = 20/55 = 4/11.

10. 2/3; 2 or 2:1; the whole includes both colors
Reasoning Total = 27; green fraction = 18/27 = 2/3.

Tape Diagrams and Totals

Ratios and Measurement

1. 32 oaks and 28 pines
Reasoning 15 equal sections total; each section is 60 ÷ 15 = 4.

2. 4 oaks and 4 pines
Reasoning 4 equal sections total; each section is 8 ÷ 4 = 2.

3. 6 oaks and 9 pines
Reasoning 5 equal sections total; each section is 15 ÷ 5 = 3.

4. 24 oaks and 8 pines
Reasoning 8 equal sections total; each section is 32 ÷ 8 = 4.

5. 14 oaks and 14 pines
Reasoning 14 equal sections total; each section is 28 ÷ 14 = 2.

6. 36 oaks and 30 pines
Reasoning 11 equal sections total; each section is 66 ÷ 11 = 6.

7. 6 oaks and 6 pines; difference 0
Reasoning 6 equal sections total; each section is 12 ÷ 6 = 2.

8. 16 oaks and 16 pines; difference 0
Reasoning 8 equal sections total; each section is 32 ÷ 8 = 4.

9. 12 oaks and 6 pines; difference 6
Reasoning 6 equal sections total; each section is 18 ÷ 6 = 3.

10. 12 oaks and 15 pines; difference 3
Reasoning 9 equal sections total; each section is 27 ÷ 9 = 3.

Equivalent Ratio Tables

Ratios and Measurement

1. 6; 9
Reasoning Multiply both parts by 2 and by 3.

2. 8; 8
Reasoning Multiply both parts by 2 and by 2.

3. 4; 8
Reasoning Multiply both parts by 2 and by 4.

4. 4; 10
Reasoning Multiply both parts by 2 and by 5.

5. 8; 24
Reasoning Multiply both parts by 2 and by 6.

6. 10; 25
Reasoning Multiply both parts by 2 and by 5.

7. 14; 42
Reasoning Multiply both parts by 2 and by 6.

8. 10; 20
Reasoning Multiply both parts by 2 and by 4.

9. 10; 20
Reasoning Multiply both parts by 2 and by 4.

10. 12; 36
Reasoning Multiply both parts by 2 and by 6.

Quiz 1

Ratios and Measurement

1. 35/4
Reasoning 15/4 × 7/3 = 35/4.

2. 6:5
Reasoning Keep red first; divide 12:10 by 2.

3. 1/2
Reasoning Total = 60; green fraction = 30/60 = 1/2.

4. 21 oaks and 9 pines; difference 12
Reasoning 10 equal sections total; each section is 30 ÷ 10 = 3.

5. 14; 42
Reasoning Multiply both parts by 2 and by 6.

Missing Values in Ratio Tables

Ratios and Measurement

1. 14; 35
Reasoning Multiply both parts by 2 and by 5.

2. 6; 6
Reasoning Multiply both parts by 2 and by 2.

3. 4; 8
Reasoning Multiply both parts by 2 and by 4.

4. 12; 12
Reasoning Multiply both parts by 2 and by 2.

5. 14; 21
Reasoning Multiply both parts by 2 and by 3.

6. 14; 42
Reasoning Multiply both parts by 2 and by 6.

7. 10; 35
Reasoning Multiply both parts by 2 and by 7.

8. 4; 10
Reasoning Multiply both parts by 2 and by 5.

9. 10; 30
Reasoning Multiply both parts by 2 and by 6.

10. 8; 28
Reasoning Multiply both parts by 2 and by 7.

Double Number Lines

Ratios and Measurement

1. 21 square meters; aligned pairs (0,0), (7,7), (21,21)
Reasoning 21 ÷ 7 = 3 batches; 3 × 7 = 21.

2. 9 square meters; aligned pairs (0,0), (3,3), (9,9)
Reasoning 9 ÷ 3 = 3 batches; 3 × 3 = 9.

3. 28 square meters; aligned pairs (0,0), (2,7), (8,28)
Reasoning 8 ÷ 2 = 4 batches; 4 × 7 = 28.

4. 6 square meters; aligned pairs (0,0), (7,2), (21,6)
Reasoning 21 ÷ 7 = 3 batches; 3 × 2 = 6.

5. 36 square meters; aligned pairs (0,0), (3,6), (18,36)
Reasoning 18 ÷ 3 = 6 batches; 6 × 6 = 36.

6. 20 square meters; aligned pairs (0,0), (6,4), (30,20)
Reasoning 30 ÷ 6 = 5 batches; 5 × 4 = 20.

7. 28 square meters; aligned pairs (0,0), (7,7), (28,28)
Reasoning 28 ÷ 7 = 4 batches; 4 × 7 = 28.

8. 42 square meters; aligned pairs (0,0), (5,7), (30,42)
Reasoning 30 ÷ 5 = 6 batches; 6 × 7 = 42.

9. 12 square meters; aligned pairs (0,0), (3,3), (12,12)
Reasoning 12 ÷ 3 = 4 batches; 4 × 3 = 12.

10. 49 square meters; aligned pairs (0,0), (4,7), (28,49)
Reasoning 28 ÷ 4 = 7 batches; 7 × 7 = 49.

Comparing Mixtures

Ratios and Measurement

1. Mix B
Reasoning For 18 cups water, A uses 36 cups juice; B uses 37. B has more juice per equal water amount.

2. Mix B
Reasoning For 42 cups water, A uses 48 cups juice; B uses 50. B has more juice per equal water amount.

3. Mix B
Reasoning For 12 cups water, A uses 12 cups juice; B uses 16. B has more juice per equal water amount.

4. Mix B
Reasoning For 6 cups water, A uses 21 cups juice; B uses 22. B has more juice per equal water amount.

5. Mix B
Reasoning For 10 cups water, A uses 20 cups juice; B uses 23. B has more juice per equal water amount.

6. Mix B
Reasoning For 15 cups water, A uses 24 cups juice; B uses 25. B has more juice per equal water amount.

7. Mix B
Reasoning For 20 cups water, A uses 30 cups juice; B uses 32. B has more juice per equal water amount.

8. Mix B
Reasoning For 25 cups water, A uses 40 cups juice; B uses 42. B has more juice per equal water amount.

9. Mix B
Reasoning For 25 cups water, A uses 25 cups juice; B uses 28. B has more juice per equal water amount.

10. Mix B
Reasoning For 16 cups water, A uses 16 cups juice; B uses 19. B has more juice per equal water amount.

Plotting Ratio Pairs

Ratios and Measurement

1. (0,0), (7,4), (14,8), (14,8); 14 tickets earns $8
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

2. (0,0), (3,3), (6,6), (15,15); 15 tickets earns $15
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

3. (0,0), (8,3), (16,6), (16,6); 16 tickets earns $6
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

4. (0,0), (8,7), (16,14), (32,28); 32 tickets earns $28
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

5. (0,0), (7,7), (14,14), (14,14); 14 tickets earns $14
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

6. (0,0), (2,2), (4,4), (8,8); 8 tickets earns $8
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

7. (0,0), (5,5), (10,10), (25,25); 25 tickets earns $25
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

8. (0,0), (8,7), (16,14), (56,49); 56 tickets earns $49
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

9. (0,0), (6,6), (12,12), (36,36); 36 tickets earns $36
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

10. (0,0), (7,4), (14,8), (42,24); 42 tickets earns $24
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

Quiz 2

Ratios and Measurement

1. 8
Reasoning 4 ÷ 1/2 = 4 × 2 = 8.

2. 4; 4
Reasoning Multiply both parts by 2 and by 2.

3. 24 square meters; aligned pairs (0,0), (3,6), (12,24)
Reasoning 12 ÷ 3 = 4 batches; 4 × 6 = 24.

4. Mix B
Reasoning For 36 cups water, A uses 24 cups juice; B uses 28. B has more juice per equal water amount.

5. (0,0), (2,3), (4,6), (12,18); 12 tickets earns $18
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

Ratios in Larger Batches

Ratios and Measurement

1. 14 oaks and 4 pines
Reasoning 9 equal sections total; each section is 18 ÷ 9 = 2.

2. 20 oaks and 25 pines
Reasoning 9 equal sections total; each section is 45 ÷ 9 = 5.

3. 48 oaks and 12 pines
Reasoning 10 equal sections total; each section is 60 ÷ 10 = 6.

4. 9 oaks and 15 pines
Reasoning 8 equal sections total; each section is 24 ÷ 8 = 3.

5. 12 oaks and 15 pines
Reasoning 9 equal sections total; each section is 27 ÷ 9 = 3.

6. 8 oaks and 24 pines
Reasoning 8 equal sections total; each section is 32 ÷ 8 = 4.

7. 25 oaks and 20 pines; difference 5
Reasoning 9 equal sections total; each section is 45 ÷ 9 = 5.

8. 32 oaks and 24 pines; difference 8
Reasoning 14 equal sections total; each section is 56 ÷ 14 = 4.

9. 20 oaks and 8 pines; difference 12
Reasoning 7 equal sections total; each section is 28 ÷ 7 = 4.

10. 12 oaks and 42 pines; difference 30
Reasoning 9 equal sections total; each section is 54 ÷ 9 = 6.

Customary and Metric Conversions

Ratios and Measurement

1. 360 minutes
Reasoning 6 × 60 = 360. Smaller units require more units for the same amount.

2. 5000 milliliters
Reasoning 5 × 1000 = 5000. Smaller units require more units for the same amount.

3. 96 inches
Reasoning 8 × 12 = 96. Smaller units require more units for the same amount.

4. 6 meters
Reasoning 600 ÷ 100 = 6; 1 meters = 100 centimeters.

5. 2000 milliliters
Reasoning 2 × 1000 = 2000. Smaller units require more units for the same amount.

6. 4 liters
Reasoning 4000 ÷ 1000 = 4; 1 liters = 1000 milliliters.

7. 250 centimeters
Reasoning 5/2 × 100 = 250. Smaller units require more units for the same amount.

8. 5/2 yards
Reasoning 15/2 ÷ 3 = 5/2; 1 yards = 3 feet.

9. 120 minutes
Reasoning 2 × 60 = 120. Smaller units require more units for the same amount.

10. 7/2 feet
Reasoning 42 ÷ 12 = 7/2; 1 feet = 12 inches.

Conversions with Fractional Amounts

Ratios and Measurement

1. 600 centimeters
Reasoning 6 × 100 = 600. Smaller units require more units for the same amount.

2. 120 minutes
Reasoning 2 × 60 = 120. Smaller units require more units for the same amount.

3. 3000 milliliters
Reasoning 3 × 1000 = 3000. Smaller units require more units for the same amount.

4. 3 liters
Reasoning 3000 ÷ 1000 = 3; 1 liters = 1000 milliliters.

5. 700 centimeters
Reasoning 7 × 100 = 700. Smaller units require more units for the same amount.

6. 8 meters
Reasoning 800 ÷ 100 = 8; 1 meters = 100 centimeters.

7. 100 centimeters
Reasoning 1 × 100 = 100. Smaller units require more units for the same amount.

8. 7/2 yards
Reasoning 21/2 ÷ 3 = 7/2; 1 yards = 3 feet.

9. 4000 milliliters
Reasoning 4 × 1000 = 4000. Smaller units require more units for the same amount.

10. 5/2 meters
Reasoning 250 ÷ 100 = 5/2; 1 meters = 100 centimeters.

Explaining Conversion Ratios

Ratios and Measurement

1. 84 inches
Reasoning 7 × 12 = 84. Smaller units require more units for the same amount.

2. 7000 milliliters
Reasoning 7 × 1000 = 7000. Smaller units require more units for the same amount.

3. 6 feet
Reasoning 2 × 3 = 6. Smaller units require more units for the same amount.

4. 3 hours
Reasoning 180 ÷ 60 = 3; 1 hours = 60 minutes.

5. 240 minutes
Reasoning 4 × 60 = 240. Smaller units require more units for the same amount.

6. 2 liters
Reasoning 2000 ÷ 1000 = 2; 1 liters = 1000 milliliters.

7. 42 inches
Reasoning 7/2 × 12 = 42. Smaller units require more units for the same amount.

8. 2 hours
Reasoning 120 ÷ 60 = 2; 1 hours = 60 minutes.

9. 3 feet
Reasoning 1 × 3 = 3. Smaller units require more units for the same amount.

10. 3/2 meters
Reasoning 150 ÷ 100 = 3/2; 1 meters = 100 centimeters.

Unit 3 Test

Ratios and Measurement

1. 1
Reasoning Each small part is 1/10; 9 shaded parts divided into groups of 9 gives 9/9 = 1 groups.

2. 1
Reasoning 1/2 ÷ 1/2 = 1/2 × 2 = 1.

3. 3 piece-lengths
Reasoning 3/4 ÷ 1/4 = 3/4 × 4 = 3.

4. 16
Reasoning 2 ÷ 1/8 = 2 × 8 = 16.

5. 4:5
Reasoning Keep red first; divide 4:5 by 1.

6. 3/4
Reasoning Total = 24; green fraction = 18/24 = 3/4.

7. 25 oaks and 20 pines
Reasoning 9 equal sections total; each section is 45 ÷ 9 = 5.

8. 12; 12
Reasoning Multiply both parts by 2 and by 2.

9. 10; 25
Reasoning Multiply both parts by 2 and by 5.

10. 6 square meters; aligned pairs (0,0), (3,2), (9,6)
Reasoning 9 ÷ 3 = 3 batches; 3 × 2 = 6.

11. Mix B
Reasoning For 25 cups water, A uses 30 cups juice; B uses 34. B has more juice per equal water amount.

12. (0,0), (5,4), (10,8), (30,24); 30 tickets earns $24
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

13. 12 oaks and 6 pines
Reasoning 9 equal sections total; each section is 18 ÷ 9 = 2.

14. 9/2 feet
Reasoning 3/2 × 3 = 9/2. Smaller units require more units for the same amount.

15. 150 centimeters
Reasoning 3/2 × 100 = 150. Smaller units require more units for the same amount.

16. 1 hours
Reasoning 60 ÷ 60 = 1; 1 hours = 60 minutes.

17. 7:4; 7/4 times as many
Reasoning Keep red first; divide 14:8 by 2.

18. 1/3; 1/2 or 1:2; the whole includes both colors
Reasoning Total = 36; green fraction = 12/36 = 1/3.

19. 18 oaks and 6 pines; difference 12
Reasoning 8 equal sections total; each section is 24 ÷ 8 = 3.

20. 8; 24
Reasoning Multiply both parts by 2 and by 6.

Unit Rates with Labels

Rates and Percents

1. $7 per notebook
Reasoning Unit rate = 28 ÷ 4 = 7 dollars per notebook.

2. $2 per notebook
Reasoning Unit rate = 10 ÷ 5 = 2 dollars per notebook.

3. $8 per notebook
Reasoning Unit rate = 40 ÷ 5 = 8 dollars per notebook.

4. $6 per notebook
Reasoning Unit rate = 24 ÷ 4 = 6 dollars per notebook.

5. $4 per notebook
Reasoning Unit rate = 28 ÷ 7 = 4 dollars per notebook.

6. $4 per notebook
Reasoning Unit rate = 12 ÷ 3 = 4 dollars per notebook.

7. $1 per notebook; $8
Reasoning Unit rate = 5 ÷ 5 = 1 dollars per notebook.

8. $4 per notebook; $20
Reasoning Unit rate = 8 ÷ 2 = 4 dollars per notebook.

9. $3.5 per notebook; $24.5
Reasoning Unit rate = 14 ÷ 4 = 3.5 dollars per notebook.

10. $4 per notebook; $28
Reasoning Unit rate = 16 ÷ 4 = 4 dollars per notebook.

Using a Unit Rate

Rates and Percents

1. $8 per notebook
Reasoning Unit rate = 32 ÷ 4 = 8 dollars per notebook.

2. $2 per notebook
Reasoning Unit rate = 8 ÷ 4 = 2 dollars per notebook.

3. $5 per notebook
Reasoning Unit rate = 30 ÷ 6 = 5 dollars per notebook.

4. $7 per notebook
Reasoning Unit rate = 42 ÷ 6 = 7 dollars per notebook.

5. $2 per notebook
Reasoning Unit rate = 4 ÷ 2 = 2 dollars per notebook.

6. $5 per notebook
Reasoning Unit rate = 15 ÷ 3 = 5 dollars per notebook.

7. $3.5 per notebook; $35
Reasoning Unit rate = 24.5 ÷ 7 = 3.5 dollars per notebook.

8. $1 per notebook; $7
Reasoning Unit rate = 4 ÷ 4 = 1 dollars per notebook.

9. $2.5 per notebook; $17.5
Reasoning Unit rate = 10 ÷ 4 = 2.5 dollars per notebook.

10. $4 per notebook; $32
Reasoning Unit rate = 20 ÷ 5 = 4 dollars per notebook.

Constant Speed

Rates and Percents

1. 40 km/h
Reasoning Speed = 80 ÷ 2 = 40; distance = speed × time.

2. 6 hours
Reasoning Time = distance ÷ speed = 120 ÷ 20 = 6.

3. 20 km/h
Reasoning Speed = 100 ÷ 5 = 20; distance = speed × time.

4. 4 hours
Reasoning Time = distance ÷ speed = 40 ÷ 10 = 4.

5. 35 km/h
Reasoning Speed = 245 ÷ 7 = 35; distance = speed × time.

6. 5 hours
Reasoning Time = distance ÷ speed = 200 ÷ 40 = 5.

7. 10 km/h; 20 km
Reasoning Speed = 30 ÷ 3 = 10; distance = speed × time.

8. 3/2 hours
Reasoning Time = distance ÷ speed = 60 ÷ 40 = 3/2.

9. 25 km/h; 100 km
Reasoning Speed = 125/2 ÷ 5/2 = 25; distance = speed × time.

10. 7/2 hours
Reasoning Time = distance ÷ speed = 245/2 ÷ 35 = 7/2.

Distance and Time

Rates and Percents

1. 20 km/h
Reasoning Speed = 120 ÷ 6 = 20; distance = speed × time.

2. 3 hours
Reasoning Time = distance ÷ speed = 120 ÷ 40 = 3.

3. 25 km/h
Reasoning Speed = 150 ÷ 6 = 25; distance = speed × time.

4. 6 hours
Reasoning Time = distance ÷ speed = 60 ÷ 10 = 6.

5. 40 km/h
Reasoning Speed = 240 ÷ 6 = 40; distance = speed × time.

6. 4 hours
Reasoning Time = distance ÷ speed = 120 ÷ 30 = 4.

7. 10 km/h; 40 km
Reasoning Speed = 25 ÷ 5/2 = 10; distance = speed × time.

8. 2 hours
Reasoning Time = distance ÷ speed = 70 ÷ 35 = 2.

9. 20 km/h; 40 km
Reasoning Speed = 20 ÷ 1 = 20; distance = speed × time.

10. 3/2 hours
Reasoning Time = distance ÷ speed = 75/2 ÷ 25 = 3/2.

Quiz 1

Rates and Percents

1. 2/9
Reasoning Total = 27; green fraction = 6/27 = 2/9.

2. $2 per notebook
Reasoning Unit rate = 6 ÷ 3 = 2 dollars per notebook.

3. $8 per notebook
Reasoning Unit rate = 16 ÷ 2 = 8 dollars per notebook.

4. 1 hours
Reasoning Time = distance ÷ speed = 20 ÷ 20 = 1.

5. 1 hours
Reasoning Time = distance ÷ speed = 15 ÷ 15 = 1.

Finding Unit Prices

Rates and Percents

1. A $3/marker; B $3.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 3 with 3.5.

2. A $2/marker; B $2.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 2 with 2.5.

3. A $6/marker; B $6.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 6 with 6.5.

4. A $2/marker; B $2.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 2 with 2.5.

5. A $3.5/marker; B $4/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 3.5 with 4.

6. A $2.5/marker; B $3/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 2.5 with 3.

7. A $2.5/marker; B $3/marker; A is cheaper; A $30, B $36
Reasoning Divide each price by its marker count; compare 2.5 with 3.

8. A $2.5/marker; B $3/marker; A is cheaper; A $227.5, B $273
Reasoning Divide each price by its marker count; compare 2.5 with 3.

9. A $4/marker; B $4.5/marker; A is cheaper; A $280, B $315
Reasoning Divide each price by its marker count; compare 4 with 4.5.

10. A $2.5/marker; B $3/marker; A is cheaper; A $60, B $72
Reasoning Divide each price by its marker count; compare 2.5 with 3.

Comparing Package Sizes

Rates and Percents

1. A $3/marker; B $3.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 3 with 3.5.

2. A $7/marker; B $7.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 7 with 7.5.

3. A $4/marker; B $4.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 4 with 4.5.

4. A $3/marker; B $3.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 3 with 3.5.

5. A $1.5/marker; B $2/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 1.5 with 2.

6. A $4/marker; B $4.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 4 with 4.5.

7. A $1.5/marker; B $2/marker; A is cheaper; A $40.5, B $54
Reasoning Divide each price by its marker count; compare 1.5 with 2.

8. A $3.5/marker; B $4/marker; A is cheaper; A $294, B $336
Reasoning Divide each price by its marker count; compare 3.5 with 4.

9. A $3/marker; B $3.5/marker; A is cheaper; A $54, B $63
Reasoning Divide each price by its marker count; compare 3 with 3.5.

10. A $4/marker; B $4.5/marker; A is cheaper; A $108, B $121.5
Reasoning Divide each price by its marker count; compare 4 with 4.5.

Percents Fractions and Decimals

Rates and Percents

1. 1/10; 0.1
Reasoning 10% = 10/100 = 1/10; divide by 100 for 0.1.

2. 1/4; 0.25
Reasoning 25% = 25/100 = 1/4; divide by 100 for 0.25.

3. 1/2; 0.5
Reasoning 50% = 50/100 = 1/2; divide by 100 for 0.5.

4. 1/5; 0.2
Reasoning 20% = 20/100 = 1/5; divide by 100 for 0.2.

5. 3/25; 0.12
Reasoning 12% = 12/100 = 3/25; divide by 100 for 0.12.

6. 3/5; 0.6
Reasoning 60% = 60/100 = 3/5; divide by 100 for 0.6.

7. 2/5; 0.4
Reasoning 40% = 40/100 = 2/5; divide by 100 for 0.4.

8. 5/4; 1.25
Reasoning 125% = 125/100 = 5/4; divide by 100 for 1.25.

9. 3/4; 0.75
Reasoning 75% = 75/100 = 3/4; divide by 100 for 0.75.

10. 1/20; 0.05
Reasoning 5% = 5/100 = 1/20; divide by 100 for 0.05.

Finding the Percent Part

Rates and Percents

1. 12
Reasoning 20/100 × 60 = 12.

2. 30
Reasoning 50/100 × 60 = 30.

3. 25
Reasoning 25/100 × 100 = 25.

4. 55
Reasoning 25/100 × 220 = 55.

5. 9
Reasoning 5/100 × 180 = 9.

6. 30
Reasoning 15/100 × 200 = 30.

7. 24
Reasoning 30/100 × 80 = 24.

8. 2
Reasoning 5/100 × 40 = 2.

9. 88
Reasoning 40/100 × 220 = 88.

10. 144
Reasoning 60/100 × 240 = 144.

Quiz 2

Rates and Percents

1. (0,0), (2,3), (4,6), (6,9); 6 tickets earns $9
Reasoning Scale both quantities by each batch count; plot horizontal tickets and vertical dollars.

2. A $2.5/marker; B $3/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 2.5 with 3.

3. A $1.5/marker; B $2/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 1.5 with 2.

4. 3/20; 0.15
Reasoning 15% = 15/100 = 3/20; divide by 100 for 0.15.

5. 8
Reasoning 20/100 × 40 = 8.

Percent Parts in Context

Rates and Percents

1. 24
Reasoning 20/100 × 120 = 24.

2. 32
Reasoning 20/100 × 160 = 32.

3. 20
Reasoning 20/100 × 100 = 20.

4. 84
Reasoning 60/100 × 140 = 84.

5. 16
Reasoning 40/100 × 40 = 16.

6. 5
Reasoning 5/100 × 100 = 5.

7. 48
Reasoning 20/100 × 240 = 48.

8. 150
Reasoning 75/100 × 200 = 150.

9. 24
Reasoning 20/100 × 120 = 24.

10. 55
Reasoning 25/100 × 220 = 55.

Finding the Whole

Rates and Percents

1. 40
Reasoning Whole = 8 ÷ 1/5 = 40. Check 20% × 40 = 8.

2. 220
Reasoning Whole = 22 ÷ 1/10 = 220. Check 10% × 220 = 22.

3. 220
Reasoning Whole = 110 ÷ 1/2 = 220. Check 50% × 220 = 110.

4. 200
Reasoning Whole = 60 ÷ 3/10 = 200. Check 30% × 200 = 60.

5. 200
Reasoning Whole = 30 ÷ 3/20 = 200. Check 15% × 200 = 30.

6. 220
Reasoning Whole = 55 ÷ 1/4 = 220. Check 25% × 220 = 55.

7. 60
Reasoning Whole = 9 ÷ 3/20 = 60. Check 15% × 60 = 9.

8. 60
Reasoning Whole = 18 ÷ 3/10 = 60. Check 30% × 60 = 18.

9. 40
Reasoning Whole = 12 ÷ 3/10 = 40. Check 30% × 40 = 12.

10. 200
Reasoning Whole = 120 ÷ 3/5 = 200. Check 60% × 200 = 120.

Finding the Percent Rate

Rates and Percents

1. 10%
Reasoning 8 ÷ 80 × 100 = 10%; the reference whole is 80.

2. 10%
Reasoning 22 ÷ 220 × 100 = 10%; the reference whole is 220.

3. 20%
Reasoning 20 ÷ 100 × 100 = 20%; the reference whole is 100.

4. 40%
Reasoning 88 ÷ 220 × 100 = 40%; the reference whole is 220.

5. 40%
Reasoning 24 ÷ 60 × 100 = 40%; the reference whole is 60.

6. 15%
Reasoning 6 ÷ 40 × 100 = 15%; the reference whole is 40.

7. 20%
Reasoning 40 ÷ 200 × 100 = 20%; the reference whole is 200.

8. 75%
Reasoning 165 ÷ 220 × 100 = 75%; the reference whole is 220.

9. 25%
Reasoning 20 ÷ 80 × 100 = 25%; the reference whole is 80.

10. 125%
Reasoning 225 ÷ 180 × 100 = 125%; the reference whole is 180.

Choosing a Percent Strategy

Rates and Percents

1. 36
Reasoning 20/100 × 180 = 36.

2. 120
Reasoning Whole = 12 ÷ 1/10 = 120. Check 10% × 120 = 12.

3. 10%
Reasoning 16 ÷ 160 × 100 = 10%; the reference whole is 160.

4. 150
Reasoning 75/100 × 200 = 150.

5. 160
Reasoning Whole = 200 ÷ 5/4 = 160. Check 125% × 160 = 200.

6. 12%
Reasoning 48/5 ÷ 80 × 100 = 12%; the reference whole is 80.

7. 54
Reasoning 30/100 × 180 = 54.

8. 180
Reasoning Whole = 9 ÷ 1/20 = 180. Check 5% × 180 = 9.

9. 125%
Reasoning 200 ÷ 160 × 100 = 125%; the reference whole is 160.

10. 18
Reasoning 30/100 × 60 = 18.

Unit 4 Test

Rates and Percents

1. 28 oaks and 16 pines
Reasoning 11 equal sections total; each section is 44 ÷ 11 = 4.

2. 10 square meters; aligned pairs (0,0), (4,5), (8,10)
Reasoning 8 ÷ 4 = 2 batches; 2 × 5 = 10.

3. 9 oaks and 6 pines
Reasoning 5 equal sections total; each section is 15 ÷ 5 = 3.

4. 3 yards
Reasoning 9 ÷ 3 = 3; 1 yards = 3 feet.

5. $4 per notebook
Reasoning Unit rate = 16 ÷ 4 = 4 dollars per notebook.

6. $7 per notebook
Reasoning Unit rate = 35 ÷ 5 = 7 dollars per notebook.

7. 15 km/h
Reasoning Speed = 90 ÷ 6 = 15; distance = speed × time.

8. 3 hours
Reasoning Time = distance ÷ speed = 105 ÷ 35 = 3.

9. A $4/marker; B $4.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 4 with 4.5.

10. A $4/marker; B $4.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 4 with 4.5.

11. 3/10; 0.3
Reasoning 30% = 30/100 = 3/10; divide by 100 for 0.3.

12. 165
Reasoning 75/100 × 220 = 165.

13. 12
Reasoning 5/100 × 240 = 12.

14. 100
Reasoning Whole = 60 ÷ 3/5 = 100. Check 60% × 100 = 60.

15. 40%
Reasoning 16 ÷ 40 × 100 = 40%; the reference whole is 40.

16. 220
Reasoning Whole = 44 ÷ 1/5 = 220. Check 20% × 220 = 44.

17. $3.5 per notebook; $28
Reasoning Unit rate = 17.5 ÷ 5 = 3.5 dollars per notebook.

18. $4 per notebook; $24
Reasoning Unit rate = 12 ÷ 3 = 4 dollars per notebook.

19. 40 km/h; 200 km
Reasoning Speed = 40 ÷ 1 = 40; distance = speed × time.

20. 7/2 hours
Reasoning Time = distance ÷ speed = 70 ÷ 20 = 7/2.

Signed Quantities and Zero

Rational Numbers and Coordinates

1. +32 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

2. -16 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

3. +21 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

4. -20 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

5. +15 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

6. -25 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

7. +35 m; 0 means at sea level; opposite -35 m
Reasoning Sea level is the reference. Below is negative and above is positive.

8. -20 m; 0 means at sea level; opposite +20 m
Reasoning Sea level is the reference. Below is negative and above is positive.

9. +12 m; 0 means at sea level; opposite -12 m
Reasoning Sea level is the reference. Below is negative and above is positive.

10. -42 m; 0 means at sea level; opposite +42 m
Reasoning Sea level is the reference. Below is negative and above is positive.

Opposites and Double Opposites

Rational Numbers and Coordinates

1. 8
Reasoning -8 and 8 are each 8 units from 0 on opposite sides.

2. 6
Reasoning -6 and 6 are each 6 units from 0 on opposite sides.

3. 5
Reasoning -5 and 5 are each 5 units from 0 on opposite sides.

4. 7/4; opposite again -7/4
Reasoning -7/4 and 7/4 are each 7/4 units from 0 on opposite sides.

5. 1; opposite again -1
Reasoning -1 and 1 are each 1 units from 0 on opposite sides.

6. 2; opposite again -2
Reasoning -2 and 2 are each 2 units from 0 on opposite sides.

7. 2/5; opposite again -2/5
Reasoning -2/5 and 2/5 are each 2/5 units from 0 on opposite sides.

8. 7; opposite again -7
Reasoning -7 and 7 are each 7 units from 0 on opposite sides.

9. 3; opposite again -3
Reasoning -3 and 3 are each 3 units from 0 on opposite sides.

10. 4/5; opposite again -4/5
Reasoning -4/5 and 4/5 are each 4/5 units from 0 on opposite sides.

Integers on Number Lines

Rational Numbers and Coordinates

1. -8 < 0 < 3; unit steps
Reasoning Negative -8 is left of or below 0; 3 is right of or above 0. Use equal intervals.

2. -8 < 0 < 2; unit steps
Reasoning Negative -8 is left of or below 0; 2 is right of or above 0. Use equal intervals.

3. -4 < 0 < 6; unit steps
Reasoning Negative -4 is left of or below 0; 6 is right of or above 0. Use equal intervals.

4. -7/3 < 0 < 1; use steps of 1/3
Reasoning Negative -7/3 is left of or below 0; 1 is right of or above 0. Use equal intervals.

5. -4/5 < 0 < 7/5; use steps of 1/5
Reasoning Negative -4/5 is left of or below 0; 7/5 is right of or above 0. Use equal intervals.

6. -2 < 0 < 5/2; use steps of 1/2
Reasoning Negative -2 is left of or below 0; 5/2 is right of or above 0. Use equal intervals.

7. -7/3 < 0 < 5/3; use steps of 1/3
Reasoning Negative -7/3 is left of or below 0; 5/3 is right of or above 0. Use equal intervals.

8. -4/5 < 0 < 2/5; use steps of 1/10
Reasoning Negative -4/5 is left of or below 0; 2/5 is right of or above 0. Use equal intervals.

9. -3/4 < 0 < 5/4; use steps of 1/4
Reasoning Negative -3/4 is left of or below 0; 5/4 is right of or above 0. Use equal intervals.

10. -2/3 < 0 < 1; use steps of 1/3
Reasoning Negative -2/3 is left of or below 0; 1 is right of or above 0. Use equal intervals.

Negative Fractions on Number Lines

Rational Numbers and Coordinates

1. -4 < 0 < 4; unit steps
Reasoning Negative -4 is left of or below 0; 4 is right of or above 0. Use equal intervals.

2. -2 < 0 < 6; unit steps
Reasoning Negative -2 is left of or below 0; 6 is right of or above 0. Use equal intervals.

3. -4 < 0 < 2; unit steps
Reasoning Negative -4 is left of or below 0; 2 is right of or above 0. Use equal intervals.

4. -1 < 0 < 3/2; use steps of 1/2
Reasoning Negative -1 is left of or below 0; 3/2 is right of or above 0. Use equal intervals.

5. -1 < 0 < 7/5; use steps of 1/5
Reasoning Negative -1 is left of or below 0; 7/5 is right of or above 0. Use equal intervals.

6. -1/5 < 0 < 1/5; use steps of 1/10
Reasoning Negative -1/5 is left of or below 0; 1/5 is right of or above 0. Use equal intervals.

7. -7/4 < 0 < 3/4; use steps of 1/4
Reasoning Negative -7/4 is left of or below 0; 3/4 is right of or above 0. Use equal intervals.

8. -5/4 < 0 < 5/4; use steps of 1/4
Reasoning Negative -5/4 is left of or below 0; 5/4 is right of or above 0. Use equal intervals.

9. -2 < 0 < 3/2; use steps of 1/2
Reasoning Negative -2 is left of or below 0; 3/2 is right of or above 0. Use equal intervals.

10. -5/3 < 0 < 5/3; use steps of 1/3
Reasoning Negative -5/3 is left of or below 0; 5/3 is right of or above 0. Use equal intervals.

Quiz 1

Rational Numbers and Coordinates

1. $6 per notebook
Reasoning Unit rate = 12 ÷ 2 = 6 dollars per notebook.

2. -6 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

3. 8; opposite again -8
Reasoning -8 and 8 are each 8 units from 0 on opposite sides.

4. -2 < 0 < 7/4; use steps of 1/4
Reasoning Negative -2 is left of or below 0; 7/4 is right of or above 0. Use equal intervals.

5. -4/5 < 0 < 7/10; use steps of 1/10
Reasoning Negative -4/5 is left of or below 0; 7/10 is right of or above 0. Use equal intervals.

Comparing Negative Values

Rational Numbers and Coordinates

1. <
Reasoning -8 < -7; greater numbers lie farther right.

2. >
Reasoning -5 > -6; greater numbers lie farther right.

3. <
Reasoning -5 < -4; greater numbers lie farther right.

4. <
Reasoning -1 < -7/10; greater numbers lie farther right.

5. <
Reasoning -2 < -1; greater numbers lie farther right.

6. <
Reasoning -5/4 < -1; greater numbers lie farther right.

7. -3/10 > -3/2; -3/10°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

8. -4/5 > -1; -4/5°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

9. -6/5 > -5/4; -6/5°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

10. -7/2 = -7/2; equal temperatures
Reasoning The greater value is farther right on a number line, even when both are negative.

Ordering Temperatures

Rational Numbers and Coordinates

1. <
Reasoning -8 < -2; greater numbers lie farther right.

2. <
Reasoning -6 < -5; greater numbers lie farther right.

3. >
Reasoning -3 > -6; greater numbers lie farther right.

4. <
Reasoning -7/4 < -5/4; greater numbers lie farther right.

5. >
Reasoning -3/10 > -3/5; greater numbers lie farther right.

6. >
Reasoning -2 > -7/3; greater numbers lie farther right.

7. -2 < -2/5; -2/5°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

8. -1 < -2/5; -2/5°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

9. -1 > -7/4; -1°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

10. -3/2 < -2/5; -2/5°C is warmer
Reasoning The greater value is farther right on a number line, even when both are negative.

Absolute Value as Distance

Rational Numbers and Coordinates

1. 16
Reasoning -16 is 16 units from 0; distance is nonnegative.

2. 35
Reasoning -35 is 35 units from 0; distance is nonnegative.

3. 6
Reasoning -6 is 6 units from 0; distance is nonnegative.

4. 3; 3 > 3/2
Reasoning -3 is 3 units from 0; distance is nonnegative.

5. 6; 6 > 3
Reasoning -6 is 6 units from 0; distance is nonnegative.

6. 8; 8 > 4
Reasoning -8 is 8 units from 0; distance is nonnegative.

7. Diver: 21 m from sea level; bird has greater elevation
Reasoning |-21| = 21 > |7/2| = 7/2, but -21 < 7/2.

8. Diver: 14 m from sea level; bird has greater elevation
Reasoning |-14| = 14 > |2| = 2, but -14 < 2.

9. Diver: 16 m from sea level; bird has greater elevation
Reasoning |-16| = 16 > |4| = 4, but -16 < 4.

10. Diver: 25/2 m from sea level; bird has greater elevation
Reasoning |-25/2| = 25/2 > |5/2| = 5/2, but -25/2 < 5/2.

Magnitude and Order

Rational Numbers and Coordinates

1. 12
Reasoning -12 is 12 units from 0; distance is nonnegative.

2. 8
Reasoning -8 is 8 units from 0; distance is nonnegative.

3. 21
Reasoning -21 is 21 units from 0; distance is nonnegative.

4. 8; 8 > 2
Reasoning -8 is 8 units from 0; distance is nonnegative.

5. 14; 14 > 2
Reasoning -14 is 14 units from 0; distance is nonnegative.

6. 12; 12 > 4
Reasoning -12 is 12 units from 0; distance is nonnegative.

7. Diver: 12 m from sea level; bird has greater elevation
Reasoning |-12| = 12 > |4| = 4, but -12 < 4.

8. Diver: 5 m from sea level; bird has greater elevation
Reasoning |-5| = 5 > |1| = 1, but -5 < 1.

9. Diver: 7 m from sea level; bird has greater elevation
Reasoning |-7| = 7 > |7/2| = 7/2, but -7 < 7/2.

10. Diver: 28 m from sea level; bird has greater elevation
Reasoning |-28| = 28 > |4| = 4, but -28 < 4.

Quiz 2

Rational Numbers and Coordinates

1. 10
Reasoning 10/100 × 100 = 10.

2. <
Reasoning -2 < -6/5; greater numbers lie farther right.

3. >
Reasoning -1 > -4/3; greater numbers lie farther right.

4. Diver: 4 m from sea level; bird has greater elevation
Reasoning |-4| = 4 > |1| = 1, but -4 < 1.

5. Diver: 6 m from sea level; bird has greater elevation
Reasoning |-6| = 6 > |3| = 3, but -6 < 3.

Points in Four Quadrants

Rational Numbers and Coordinates

1. Quadrant III
Reasoning Move 2 left, then 3 down.

2. Quadrant IV
Reasoning Move 7 right, then 5 down.

3. Quadrant II
Reasoning Move 7 left, then 4 up.

4. Quadrant IV
Reasoning Move 4 right, then 2 down.

5. Quadrant III
Reasoning Move 6 left, then 4 down.

6. Quadrant I
Reasoning Move 5 right, then 4 up.

7. Quadrant III; Q(0, -3/2)
Reasoning Move 7/2 left, then 3/2 down.

8. Quadrant IV; Q(0, -7/2)
Reasoning Move 4 right, then 7/2 down.

9. Quadrant II; Q(0, 5/2)
Reasoning Move 5/2 left, then 5/2 up.

10. Quadrant IV; Q(0, -3)
Reasoning Move 7/2 right, then 3 down.

Reflections and Coordinate Signs

Rational Numbers and Coordinates

1. (-8, -6)
Reasoning Reverse the y sign: (-8, -6).

2. (2, -5)
Reasoning Reverse the x sign: (2, -5).

3. (-5, -6)
Reasoning Reverse the y sign: (-5, -6).

4. (4, -2)
Reasoning Reverse the x sign: (4, -2).

5. (-7, -4)
Reasoning Reverse the y sign: (-7, -4).

6. (2, -7)
Reasoning Reverse the x sign: (2, -7).

7. (2, -3)
Reasoning Reverse both signs: (2, -3).

8. (7, 3)
Reasoning Reverse both signs: (7, 3).

9. (6, -2)
Reasoning Reverse both signs: (6, -2).

10. (8, 7)
Reasoning Reverse both signs: (8, 7).

Horizontal and Vertical Distances

Rational Numbers and Coordinates

1. 2 units
Reasoning Only one coordinate changes. Same side of 0: subtract magnitudes to get 2.

2. 3 units
Reasoning Only one coordinate changes. Same side of 0: subtract magnitudes to get 3.

3. 5 units
Reasoning Only one coordinate changes. Same side of 0: subtract magnitudes to get 5.

4. 13 units
Reasoning Only one coordinate changes. Opposite sides of 0: 6 + 7 = 13.

5. 8 units
Reasoning Only one coordinate changes. Opposite sides of 0: 2 + 6 = 8.

6. 5 units
Reasoning Only one coordinate changes. Opposite sides of 0: 3 + 2 = 5.

7. 10 units
Reasoning Only one coordinate changes. Opposite sides of 0: 8 + 2 = 10.

8. 10 units
Reasoning Only one coordinate changes. Opposite sides of 0: 7 + 3 = 10.

9. 10 units
Reasoning Only one coordinate changes. Opposite sides of 0: 6 + 4 = 10.

10. 13 units
Reasoning Only one coordinate changes. Opposite sides of 0: 8 + 5 = 13.

Distances Across the Axes

Rational Numbers and Coordinates

1. 4 units
Reasoning Only one coordinate changes. Same side of 0: subtract magnitudes to get 4.

2. 4 units
Reasoning Only one coordinate changes. Same side of 0: subtract magnitudes to get 4.

3. 6 units
Reasoning Only one coordinate changes. Same side of 0: subtract magnitudes to get 6.

4. 11 units
Reasoning Only one coordinate changes. Opposite sides of 0: 8 + 3 = 11.

5. 4 units
Reasoning Only one coordinate changes. Opposite sides of 0: 2 + 2 = 4.

6. 6 units
Reasoning Only one coordinate changes. Opposite sides of 0: 3 + 3 = 6.

7. 11 units
Reasoning Only one coordinate changes. Opposite sides of 0: 5 + 6 = 11.

8. 10 units
Reasoning Only one coordinate changes. Opposite sides of 0: 8 + 2 = 10.

9. 13 units
Reasoning Only one coordinate changes. Opposite sides of 0: 8 + 5 = 13.

10. 6 units
Reasoning Only one coordinate changes. Opposite sides of 0: 3 + 3 = 6.

Unit 5 Test

Rational Numbers and Coordinates

1. 40 km/h
Reasoning Speed = 200 ÷ 5 = 40; distance = speed × time.

2. A $4/marker; B $4.5/marker; A is cheaper
Reasoning Divide each price by its marker count; compare 4 with 4.5.

3. 20
Reasoning 50/100 × 40 = 20.

4. 64
Reasoning 40/100 × 160 = 64.

5. +18 m; 0 means at sea level
Reasoning Sea level is the reference. Below is negative and above is positive.

6. 7
Reasoning -7 and 7 are each 7 units from 0 on opposite sides.

7. -6 < 0 < 6; unit steps
Reasoning Negative -6 is left of or below 0; 6 is right of or above 0. Use equal intervals.

8. -1/2 < 0 < 3/2; use steps of 1/4
Reasoning Negative -1/2 is left of or below 0; 3/2 is right of or above 0. Use equal intervals.

9. <
Reasoning -1 < -1/2; greater numbers lie farther right.

10. >
Reasoning -2/5 > -5/3; greater numbers lie farther right.

11. 4; 4 > 2
Reasoning -4 is 4 units from 0; distance is nonnegative.

12. 21; 21 > 3
Reasoning -21 is 21 units from 0; distance is nonnegative.

13. Quadrant I
Reasoning Move 4 right, then 5 up.

14. (3, -7)
Reasoning Reverse both signs: (3, -7).

15. 14 units
Reasoning Only one coordinate changes. Opposite sides of 0: 7 + 7 = 14.

16. 9 units
Reasoning Only one coordinate changes. Opposite sides of 0: 6 + 3 = 9.

17. -16 m; 0 means at sea level; opposite +16 m
Reasoning Sea level is the reference. Below is negative and above is positive.

18. 7/5; opposite again -7/5
Reasoning -7/5 and 7/5 are each 7/5 units from 0 on opposite sides.

19. -2/3 < 0 < 4/3; use steps of 1/3
Reasoning Negative -2/3 is left of or below 0; 4/3 is right of or above 0. Use equal intervals.

20. -2 < 0 < 7/3; use steps of 1/3
Reasoning Negative -2 is left of or below 0; 7/3 is right of or above 0. Use equal intervals.

Repeated Factors and Exponents

Expressions and Equivalence

1. 3 × 3 × 3 × 3 = 81
Reasoning The exponent counts 4 factors of 3; multiply all factors.

2. 4 × 4 × 4 × 4 = 256
Reasoning The exponent counts 4 factors of 4; multiply all factors.

3. 2 × 2 × 2 = 8
Reasoning The exponent counts 3 factors of 2; multiply all factors.

4. 6 × 6 × 6 = 216
Reasoning The exponent counts 3 factors of 6; multiply all factors.

5. 2 × 2 × 2 × 2 = 16
Reasoning The exponent counts 4 factors of 2; multiply all factors.

6. 5 × 5 × 5 × 5 = 625
Reasoning The exponent counts 4 factors of 5; multiply all factors.

7. 7 × 7 = 49; 7 × 2 = 14
Reasoning The exponent counts 2 factors of 7; multiply all factors.

8. 4 × 4 × 4 = 64; 4 × 3 = 12
Reasoning The exponent counts 3 factors of 4; multiply all factors.

9. 6 × 6 = 36; 6 × 2 = 12
Reasoning The exponent counts 2 factors of 6; multiply all factors.

10. 2 × 2 × 2 = 8; 2 × 3 = 6
Reasoning The exponent counts 3 factors of 2; multiply all factors.

Powers and Their Values

Expressions and Equivalence

1. 2 × 2 = 4
Reasoning The exponent counts 2 factors of 2; multiply all factors.

2. 3 × 3 × 3 = 27
Reasoning The exponent counts 3 factors of 3; multiply all factors.

3. 4 × 4 × 4 = 64
Reasoning The exponent counts 3 factors of 4; multiply all factors.

4. 8 × 8 = 64
Reasoning The exponent counts 2 factors of 8; multiply all factors.

5. 7 × 7 × 7 = 343
Reasoning The exponent counts 3 factors of 7; multiply all factors.

6. 4 × 4 = 16
Reasoning The exponent counts 2 factors of 4; multiply all factors.

7. 6 × 6 × 6 × 6 = 1296; 6 × 4 = 24
Reasoning The exponent counts 4 factors of 6; multiply all factors.

8. 3 × 3 = 9; 3 × 2 = 6
Reasoning The exponent counts 2 factors of 3; multiply all factors.

9. 3 × 3 × 3 × 3 = 81; 3 × 4 = 12
Reasoning The exponent counts 4 factors of 3; multiply all factors.

10. 7 × 7 × 7 × 7 = 2401; 7 × 4 = 28
Reasoning The exponent counts 4 factors of 7; multiply all factors.

Order of Operations

Expressions and Equivalence

1. 25
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 25.

2. 10
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 10.

3. 33
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 33.

4. 208
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 208.

5. 36
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 36.

6. 144
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 144.

7. 44
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 44.

8. 37
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 37.

9. 26
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 26.

10. 22
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 22.

Grouping and Left to Right Operations

Expressions and Equivalence

1. 11
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 11.

2. 15
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 15.

3. 16
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 16.

4. 216
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 216.

5. 96
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 96.

6. 432
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 432.

7. 45
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 45.

8. 50
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 50.

9. 20
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 20.

10. 60
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 60.

Quiz 1

Expressions and Equivalence

1. 2
Reasoning -2 and 2 are each 2 units from 0 on opposite sides.

2. 5 × 5 = 25
Reasoning The exponent counts 2 factors of 5; multiply all factors.

3. 7 × 7 × 7 × 7 = 2401
Reasoning The exponent counts 4 factors of 7; multiply all factors.

4. 28
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 28.

5. 46
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 46.

Parts of an Expression

Expressions and Equivalence

1. Terms 7x, 5y, 3; coefficients 7, 5; constant 3
Reasoning Terms are separated by addition; coefficients multiply variables.

2. Terms 4x, 4y, 6; coefficients 4, 4; constant 6
Reasoning Terms are separated by addition; coefficients multiply variables.

3. Outer quotient; dividend (2x + 3); divisor 2; inner sum 2x + 3
Reasoning The grouped sum is one complete quantity being divided. Within it, the terms are 2x and 3.

4. Terms 3x, 4y, 3; coefficients 3, 4; constant 3
Reasoning Terms are separated by addition; coefficients multiply variables.

5. Outer quotient; dividend (2x + 2); divisor 5; inner sum 2x + 2
Reasoning The grouped sum is one complete quantity being divided. Within it, the terms are 2x and 2.

6. Terms 2x, 6y, 4; coefficients 2, 6; constant 4
Reasoning Terms are separated by addition; coefficients multiply variables.

7. Outer quotient; dividend (5x + 6); divisor 5; inner sum 5x + 6
Reasoning The grouped sum is one complete quantity being divided. Within it, the terms are 5x and 6.

8. Outer product; factors 5 and (x + 3); inner sum
Reasoning The complete sum (x + 3) is one factor multiplied by 5.

9. Outer product; factors 3 and (x + 5); inner sum
Reasoning The complete sum (x + 5) is one factor multiplied by 3.

10. Outer product; factors 7 and (x + 6); inner sum
Reasoning The complete sum (x + 6) is one factor multiplied by 7.

Words to Expressions

Expressions and Equivalence

1. n - 2
Reasoning Start with n, then subtract the named amount.

2. n - 6
Reasoning Start with n, then subtract the named amount.

3. n - 5
Reasoning Start with n, then subtract the named amount.

4. 3(x + 2)
Reasoning Group the sum before multiplying.

5. 3(x + 6)
Reasoning Group the sum before multiplying.

6. 3(x + 3)
Reasoning Group the sum before multiplying.

7. n = ticket count; 2n + 7; $13
Reasoning Ticket cost is 2 × n; add the one-time fee 7.

8. n = ticket count; 7n + 5; $19
Reasoning Ticket cost is 7 × n; add the one-time fee 5.

9. n = ticket count; 6n + 3; $27
Reasoning Ticket cost is 6 × n; add the one-time fee 3.

10. n = ticket count; 3n + 4; $16
Reasoning Ticket cost is 3 × n; add the one-time fee 4.

Expressions for Costs

Expressions and Equivalence

1. n - 4
Reasoning Start with n, then subtract the named amount.

2. n - 3
Reasoning Start with n, then subtract the named amount.

3. n - 7
Reasoning Start with n, then subtract the named amount.

4. 6(x + 6)
Reasoning Group the sum before multiplying.

5. 5(x + 2)
Reasoning Group the sum before multiplying.

6. 7(x + 7)
Reasoning Group the sum before multiplying.

7. n = ticket count; 6n + 7; $31
Reasoning Ticket cost is 6 × n; add the one-time fee 7.

8. n = ticket count; 4n + 5; $13
Reasoning Ticket cost is 4 × n; add the one-time fee 5.

9. n = ticket count; 5n + 4; $14
Reasoning Ticket cost is 5 × n; add the one-time fee 4.

10. n = ticket count; 4n + 2; $22
Reasoning Ticket cost is 4 × n; add the one-time fee 2.

Substitution and Evaluation

Expressions and Equivalence

1. 20
Reasoning Substitute first: 7 × 2 + 6 = 20.

2. 46
Reasoning Substitute first: 8 × 5 + 6 = 46.

3. 14
Reasoning Substitute first: 2 × 4 + 6 = 14.

4. 24
Reasoning Substitute first: 4^2 + 2 × 4 = 24.

5. 57
Reasoning Substitute first: 5^2 + 8 × 4 = 57.

6. 46
Reasoning Substitute first: 5^2 + 7 × 3 = 46.

7. A = 6(x + 5); 54 square units
Reasoning Substitute x = 4: 6(4 + 5) = 54.

8. A = 6(x + 6); 54 square units
Reasoning Substitute x = 3: 6(3 + 6) = 54.

9. A = 3(x + 2); 24 square units
Reasoning Substitute x = 6: 3(6 + 2) = 24.

10. A = 4(x + 4); 28 square units
Reasoning Substitute x = 3: 4(3 + 4) = 28.

Quiz 2

Expressions and Equivalence

1. 15
Reasoning -15 is 15 units from 0; distance is nonnegative.

2. Terms 5x, 2y, 2; coefficients 5, 2; constant 2
Reasoning Terms are separated by addition; coefficients multiply variables.

3. 5(x + 5)
Reasoning Group the sum before multiplying.

4. n = ticket count; 4n + 3; $27
Reasoning Ticket cost is 4 × n; add the one-time fee 3.

5. A = 4(x + 4); 40 square units
Reasoning Substitute x = 6: 4(6 + 4) = 40.

Evaluating Formulas

Expressions and Equivalence

1. 14
Reasoning Substitute first: 2 × 6 + 2 = 14.

2. 52
Reasoning Substitute first: 8 × 6 + 4 = 52.

3. 14
Reasoning Substitute first: 4 × 2 + 6 = 14.

4. 65
Reasoning Substitute first: 5^2 + 8 × 5 = 65.

5. 55
Reasoning Substitute first: 5^2 + 5 × 6 = 55.

6. 33
Reasoning Substitute first: 3^2 + 8 × 3 = 33.

7. A = 6(x + 7); 78 square units
Reasoning Substitute x = 6: 6(6 + 7) = 78.

8. A = 4(x + 5); 36 square units
Reasoning Substitute x = 4: 4(4 + 5) = 36.

9. A = 5(x + 5); 50 square units
Reasoning Substitute x = 5: 5(5 + 5) = 50.

10. A = 6(x + 4); 60 square units
Reasoning Substitute x = 6: 6(6 + 4) = 60.

Distributing a Factor

Expressions and Equivalence

1. 5x + 10
Reasoning Multiply the outside factor by every inside term, including the constant.

2. 8x + 16
Reasoning Multiply the outside factor by every inside term, including the constant.

3. 7x + 14
Reasoning Multiply the outside factor by every inside term, including the constant.

4. 12x + 18
Reasoning Multiply the outside factor by every inside term, including the constant.

5. 28x + 21
Reasoning Multiply the outside factor by every inside term, including the constant.

6. 28x + 14
Reasoning Multiply the outside factor by every inside term, including the constant.

7. 21x + 12; both give 54 at x = 2
Reasoning Multiply the outside factor by every inside term, including the constant.

8. 10x + 25; both give 45 at x = 2
Reasoning Multiply the outside factor by every inside term, including the constant.

9. 40x + 48; both give 128 at x = 2
Reasoning Multiply the outside factor by every inside term, including the constant.

10. 48x + 24; both give 120 at x = 2
Reasoning Multiply the outside factor by every inside term, including the constant.

Combining Like Terms

Expressions and Equivalence

1. 9x
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

2. 8x
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

3. 7x
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

4. 5x + 9
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

5. 7x + 10
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

6. 7x + 6
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

7. 13x + 24
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

8. 9x + 15
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

9. 11x + 21
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

10. 11x + 16
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

Proving or Disproving Equivalence

Expressions and Equivalence

1. No; at x = 0, values are 40 and 5
Reasoning 8(x + 5) = 8x + 40. The constants 40 and 5 differ.

2. Yes; distribution gives 4x + 16
Reasoning 4(x + 4) = 4x + 16. This matches.

3. No; at x = 0, values are 16 and 2
Reasoning 8(x + 2) = 8x + 16. The constants 16 and 2 differ.

4. Yes; distribution gives 5x + 15
Reasoning 5(x + 3) = 5x + 15. This matches.

5. No; at x = 0, values are 35 and 5
Reasoning 7(x + 5) = 7x + 35. The constants 35 and 5 differ.

6. Yes; distribution gives 7x + 14
Reasoning 7(x + 2) = 7x + 14. This matches.

7. No; at x = 0, values are 12 and 3
Reasoning 4(x + 3) = 4x + 12. The constants 12 and 3 differ.

8. Yes; distribution gives 6x + 30
Reasoning 6(x + 5) = 6x + 30. This matches.

9. No; at x = 0, values are 35 and 7
Reasoning 5(x + 7) = 5x + 35. The constants 35 and 7 differ.

10. Yes; distribution gives 2x + 8
Reasoning 2(x + 4) = 2x + 8. This matches.

Unit 6 Test

Expressions and Equivalence

1. -4 < 0 < 3; unit steps
Reasoning Negative -4 is left of or below 0; 3 is right of or above 0. Use equal intervals.

2. <
Reasoning -5 < -3; greater numbers lie farther right.

3. Quadrant II
Reasoning Move 3 left, then 2 up.

4. 11 units
Reasoning Only one coordinate changes. Opposite sides of 0: 7 + 4 = 11.

5. 4 × 4 × 4 × 4 = 256
Reasoning The exponent counts 4 factors of 4; multiply all factors.

6. 3 × 3 = 9
Reasoning The exponent counts 2 factors of 3; multiply all factors.

7. 14
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 14.

8. 250
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 250.

9. Terms 2x, 2y, 3; coefficients 2, 2; constant 3
Reasoning Terms are separated by addition; coefficients multiply variables.

10. 5(x + 6)
Reasoning Group the sum before multiplying.

11. 2(x + 4)
Reasoning Group the sum before multiplying.

12. 60
Reasoning Substitute first: 6^2 + 6 × 4 = 60.

13. 40
Reasoning Substitute first: 2^2 + 6 × 6 = 40.

14. 15x + 15; both give 45 at x = 2
Reasoning Multiply the outside factor by every inside term, including the constant.

15. 10x + 16
Reasoning Add coefficients of x terms; add only constants to constants. Distribute first if needed.

16. Yes; distribution gives 3x + 9
Reasoning 3(x + 3) = 3x + 9. This matches.

17. 5 × 5 × 5 = 125; 5 × 3 = 15
Reasoning The exponent counts 3 factors of 5; multiply all factors.

18. 4 × 4 × 4 × 4 = 256; 4 × 4 = 16
Reasoning The exponent counts 4 factors of 4; multiply all factors.

19. 46
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 46.

20. 81
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 81.

Testing Equation Solutions

Equations Inequalities and Relationships

1. No; left side = 13
Reasoning 3 × 3 + 4 = 13; compare with 10.

2. Yes; left side = 20
Reasoning 4 × 4 + 4 = 20; compare with 20.

3. No; left side = 24
Reasoning 3 × 6 + 6 = 24; compare with 21.

4. Yes; left side = 28
Reasoning 4 × 6 + 4 = 28; compare with 28.

5. No; left side = 13
Reasoning 2 × 3 + 7 = 13; compare with 11.

6. Yes; left side = 15
Reasoning 3 × 4 + 3 = 15; compare with 15.

7. No; left side = 23
Reasoning 4 × 4 + 7 = 23; compare with 19.

8. Yes; left side = 11
Reasoning 3 × 3 + 2 = 11; compare with 11.

9. No; left side = 17
Reasoning 3 × 5 + 2 = 17; compare with 14.

10. Yes; left side = 37
Reasoning 7 × 5 + 2 = 37; compare with 37.

Solving Addition Equations

Equations Inequalities and Relationships

1. x = 3
Reasoning Subtract 6 on both sides. Then x = 3; substitution gives 9 on each side.

2. x = 5
Reasoning Subtract 4 on both sides. Then x = 5; substitution gives 9 on each side.

3. x = 4
Reasoning Subtract 6 on both sides. Then x = 4; substitution gives 10 on each side.

4. x = 5/2
Reasoning Subtract 8 on both sides. Then x = 5/2; substitution gives 21/2 on each side.

5. x = 5/2
Reasoning Subtract 7 on both sides. Then x = 5/2; substitution gives 19/2 on each side.

6. x = 5/2
Reasoning Subtract 5 on both sides. Then x = 5/2; substitution gives 15/2 on each side.

7. x = 3/2
Reasoning Subtract 3/2 on both sides. Then x = 3/2; substitution gives 3 on each side.

8. x = 3/2
Reasoning Subtract 1 on both sides. Then x = 3/2; substitution gives 5/2 on each side.

9. x = 3/2
Reasoning Subtract 2 on both sides. Then x = 3/2; substitution gives 7/2 on each side.

10. x = 2
Reasoning Subtract 2 on both sides. Then x = 2; substitution gives 4 on each side.

Solving Subtraction Equations

Equations Inequalities and Relationships

1. x = 19/2
Reasoning Add 8 on both sides. Then x = 19/2; substitution gives 3/2 on each side.

2. x = 9
Reasoning Add 8 on both sides. Then x = 9; substitution gives 1 on each side.

3. x = 7
Reasoning Add 5 on both sides. Then x = 7; substitution gives 2 on each side.

4. x = 10
Reasoning Add 7 on both sides. Then x = 10; substitution gives 3 on each side.

5. x = 9
Reasoning Add 6 on both sides. Then x = 9; substitution gives 3 on each side.

6. x = 15/2
Reasoning Add 5 on both sides. Then x = 15/2; substitution gives 5/2 on each side.

7. x = 7/2
Reasoning Add 1 on both sides. Then x = 7/2; substitution gives 5/2 on each side.

8. x = 5
Reasoning Add 4 on both sides. Then x = 5; substitution gives 1 on each side.

9. x = 13/2
Reasoning Add 4 on both sides. Then x = 13/2; substitution gives 5/2 on each side.

10. x = 3/2
Reasoning Add 3/2 on both sides. Then x = 3/2; substitution gives 0 on each side.

Solving Multiplication Equations

Equations Inequalities and Relationships

1. x = 7
Reasoning Divide by 4 on both sides. Then x = 7; substitution gives 28 on each side.

2. x = 4
Reasoning Divide by 6 on both sides. Then x = 4; substitution gives 24 on each side.

3. x = 3
Reasoning Divide by 3 on both sides. Then x = 3; substitution gives 9 on each side.

4. x = 3
Reasoning Divide by 4 on both sides. Then x = 3; substitution gives 12 on each side.

5. x = 2
Reasoning Divide by 2 on both sides. Then x = 2; substitution gives 4 on each side.

6. x = 5/2
Reasoning Divide by 6 on both sides. Then x = 5/2; substitution gives 15 on each side.

7. x = 1
Reasoning Divide by 3/2 on both sides. Then x = 1; substitution gives 3/2 on each side.

8. x = 1
Reasoning Divide by 3 on both sides. Then x = 1; substitution gives 3 on each side.

9. x = 5/2
Reasoning Divide by 3/2 on both sides. Then x = 5/2; substitution gives 15/4 on each side.

10. x = 2
Reasoning Divide by 1 on both sides. Then x = 2; substitution gives 2 on each side.

Quiz 1

Equations Inequalities and Relationships

1. 2 × 2 × 2 × 2 = 16
Reasoning The exponent counts 4 factors of 2; multiply all factors.

2. Yes; left side = 29
Reasoning 5 × 5 + 4 = 29; compare with 29.

3. x = 3/2
Reasoning Subtract 5 on both sides. Then x = 3/2; substitution gives 13/2 on each side.

4. x = 5/2
Reasoning Add 2 on both sides. Then x = 5/2; substitution gives 1/2 on each side.

5. x = 2
Reasoning Divide by 5/2 on both sides. Then x = 2; substitution gives 5 on each side.

Solving Division Equations

Equations Inequalities and Relationships

1. x = 7
Reasoning Multiply by 8 on both sides. Then x = 7; substitution gives 7/8 on each side.

2. x = 6
Reasoning Multiply by 5 on both sides. Then x = 6; substitution gives 6/5 on each side.

3. x = 6
Reasoning Multiply by 7 on both sides. Then x = 6; substitution gives 6/7 on each side.

4. x = 5/2
Reasoning Multiply by 8 on both sides. Then x = 5/2; substitution gives 5/16 on each side.

5. x = 2
Reasoning Multiply by 6 on both sides. Then x = 2; substitution gives 1/3 on each side.

6. x = 5/2
Reasoning Multiply by 3 on both sides. Then x = 5/2; substitution gives 5/6 on each side.

7. x = 5/2
Reasoning Multiply by 2 on both sides. Then x = 5/2; substitution gives 5/4 on each side.

8. x = 3
Reasoning Multiply by 1 on both sides. Then x = 3; substitution gives 3 on each side.

9. x = 3
Reasoning Multiply by 7/2 on both sides. Then x = 3; substitution gives 6/7 on each side.

10. x = 2
Reasoning Multiply by 7/2 on both sides. Then x = 2; substitution gives 4/7 on each side.

One Step Equation Models

Equations Inequalities and Relationships

1. x + 4 = 12; x = 8 cards
Reasoning Subtract 4 from both sides; 8 + 4 = 12.

2. x + 8 = 56; x = 48 cards
Reasoning Subtract 8 from both sides; 48 + 8 = 56.

3. x + 3 = 6; x = 3 cards
Reasoning Subtract 3 from both sides; 3 + 3 = 6.

4. 7x = 28; x = 4 m
Reasoning Divide the total by 7: 28 ÷ 7 = 4.

5. 5x = 10; x = 2 m
Reasoning Divide the total by 5: 10 ÷ 5 = 2.

6. 6x = 24; x = 4 m
Reasoning Divide the total by 6: 24 ÷ 6 = 4.

7. 4x = 16; x = 4 m
Reasoning Divide the total by 4: 16 ÷ 4 = 4.

8. 2x = 6; x = 3 m
Reasoning Divide the total by 2: 6 ÷ 2 = 3.

9. 3x = 9/2; x = 3/2 m
Reasoning Divide the total by 3: 9/2 ÷ 3 = 3/2.

10. 5x = 20; x = 4 m
Reasoning Divide the total by 5: 20 ÷ 5 = 4.

Writing and Graphing Inequalities

Equations Inequalities and Relationships

1. x > 16; open circle at 16, shade right
Reasoning “more than” means >; exclude the endpoint.

2. x < 12; open circle at 12, shade left
Reasoning “less than” means <; exclude the endpoint.

3. x > 12; open circle at 12, shade right
Reasoning “more than” means >; exclude the endpoint.

4. x < 24; open circle at 24, shade left
Reasoning “less than” means <; exclude the endpoint.

5. x > 15; open circle at 15, shade right
Reasoning “more than” means >; exclude the endpoint.

6. x > 10; open circle at 10, shade right
Reasoning “more than” means >; exclude the endpoint.

7. x ≥ 49; closed circle at 49, shade right
Reasoning “at least” means ≥; include the endpoint. Example solution: 50.

8. x ≥ 20; closed circle at 20, shade right
Reasoning “at least” means ≥; include the endpoint. Example solution: 21.

9. p > 8; open circle at 8, shade right; participant counts are whole numbers 9, 10, …
Reasoning “more than” means >. The real-number ray has infinitely many solutions, but participant counts must be whole numbers.

10. p ≥ 42; closed circle at 42, shade right; participant counts are whole numbers 42, 43, …
Reasoning “at least” means ≥. The real-number ray has infinitely many solutions, but participant counts must be whole numbers.

Testing Inequality Solutions

Equations Inequalities and Relationships

1. 10
Reasoning Values below 11 work; the endpoint does not work.

2. 5, 6
Reasoning Values below 6 work; the endpoint works too.

3. 8
Reasoning Values below 9 work; the endpoint does not work.

4. 3, 4
Reasoning Values below 4 work; the endpoint works too.

5. 9
Reasoning Values below 10 work; the endpoint does not work.

6. 14, 15
Reasoning Values below 15 work; the endpoint works too.

7. 7; no, infinitely many real values satisfy it
Reasoning Values below 8 work; the endpoint does not work.

8. 5, 6; no, infinitely many real values satisfy it
Reasoning Values below 6 work; the endpoint works too.

9. 9; no, infinitely many real values satisfy it
Reasoning Values below 10 work; the endpoint does not work.

10. 14, 15; no, infinitely many real values satisfy it
Reasoning Values below 15 work; the endpoint works too.

Quiz 2

Equations Inequalities and Relationships

1. 22
Reasoning Substitute first: 8 × 2 + 6 = 22.

2. x = 1
Reasoning Multiply by 5 on both sides. Then x = 1; substitution gives 1/5 on each side.

3. 6x = 42; x = 7 m
Reasoning Divide the total by 6: 42 ÷ 6 = 7.

4. x ≤ 28; closed circle at 28, shade left
Reasoning “at most” means ≤; include the endpoint. Example solution: 27.

5. 9, 10; no, infinitely many real values satisfy it
Reasoning Values below 10 work; the endpoint works too.

Endpoints and Infinite Solutions

Equations Inequalities and Relationships

1. x > 21; open circle at 21, shade right
Reasoning “more than” means >; exclude the endpoint.

2. x ≥ 28; closed circle at 28, shade right
Reasoning “at least” means ≥; include the endpoint.

3. x ≥ 16; closed circle at 16, shade right
Reasoning “at least” means ≥; include the endpoint.

4. x < 21; open circle at 21, shade left
Reasoning “less than” means <; exclude the endpoint.

5. x < 15; open circle at 15, shade left
Reasoning “less than” means <; exclude the endpoint.

6. x ≥ 20; closed circle at 20, shade right
Reasoning “at least” means ≥; include the endpoint.

7. x ≤ 15; closed circle at 15, shade left
Reasoning “at most” means ≤; include the endpoint. Example solution: 14.

8. x ≤ 18; closed circle at 18, shade left
Reasoning “at most” means ≤; include the endpoint. Example solution: 17.

9. p > 10; open circle at 10, shade right; participant counts are whole numbers 11, 12, …
Reasoning “more than” means >. The real-number ray has infinitely many solutions, but participant counts must be whole numbers.

10. p ≥ 20; closed circle at 20, shade right; participant counts are whole numbers 20, 21, …
Reasoning “at least” means ≥. The real-number ray has infinitely many solutions, but participant counts must be whole numbers.

Dependent and Independent Variables

Equations Inequalities and Relationships

1. Independent n = notebooks; dependent C = cost; C = 6n
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

2. Independent n = notebooks; dependent C = cost; C = 2n
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

3. Independent n = notebooks; dependent C = cost; C = 8n
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

4. Independent n = notebooks; dependent C = cost; C = 4n + 3
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

5. Independent n = notebooks; dependent C = cost; C = 5n + 3
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

6. Independent n = notebooks; dependent C = cost; C = 3n + 4
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

7. Independent n = notebooks; dependent C = cost; C = 2n + 5; C(0) = $5, the fee
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

8. Independent n = notebooks; dependent C = cost; C = 3n + 5; C(0) = $5, the fee
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

9. Independent n = notebooks; dependent C = cost; C = 2n + 2; C(0) = $2, the fee
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

10. Independent n = notebooks; dependent C = cost; C = 4n + 5; C(0) = $5, the fee
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

Rules Tables and Graphs

Equations Inequalities and Relationships

1. (0, 0); (1, 2); (2, 4); (6, 12)
Reasoning Substitute each input into y = 2x; x is horizontal and y vertical.

2. (0, 0); (1, 4); (2, 8); (3, 12)
Reasoning Substitute each input into y = 4x; x is horizontal and y vertical.

3. (0, 0); (1, 7); (2, 14); (4, 28)
Reasoning Substitute each input into y = 7x; x is horizontal and y vertical.

4. (0, 7); (1, 10); (2, 13); (5, 22)
Reasoning Substitute each input into y = 3x + 7; x is horizontal and y vertical.

5. (0, 3); (1, 10); (2, 17); (4, 31)
Reasoning Substitute each input into y = 7x + 3; x is horizontal and y vertical.

6. (0, 5); (1, 9); (2, 13); (3, 17)
Reasoning Substitute each input into y = 4x + 5; x is horizontal and y vertical.

7. (0, 6); (1, 13); (2, 20); (3, 27); y increases by 7
Reasoning Substitute each input into y = 7x + 6; x is horizontal and y vertical.

8. (0, 5); (1, 11); (2, 17); (4, 29); y increases by 6
Reasoning Substitute each input into y = 6x + 5; x is horizontal and y vertical.

9. (0, 3); (1, 8); (2, 13); y increases by 5
Reasoning Substitute each input into y = 5x + 3; x is horizontal and y vertical.

10. (0, 6); (1, 11); (2, 16); (4, 26); y increases by 5
Reasoning Substitute each input into y = 5x + 6; x is horizontal and y vertical.

Interpreting Input Output Patterns

Equations Inequalities and Relationships

1. (0, 0); (1, 6); (2, 12); (4, 24)
Reasoning Substitute each input into y = 6x; x is horizontal and y vertical.

2. (0, 0); (1, 5); (2, 10); (6, 30)
Reasoning Substitute each input into y = 5x; x is horizontal and y vertical.

3. (0, 0); (1, 8); (2, 16); (5, 40)
Reasoning Substitute each input into y = 8x; x is horizontal and y vertical.

4. (0, 3); (1, 10); (2, 17); (6, 45)
Reasoning Substitute each input into y = 7x + 3; x is horizontal and y vertical.

5. (0, 5); (1, 10); (2, 15); (4, 25)
Reasoning Substitute each input into y = 5x + 5; x is horizontal and y vertical.

6. (0, 3); (1, 5); (2, 7)
Reasoning Substitute each input into y = 2x + 3; x is horizontal and y vertical.

7. (0, 3); (1, 11); (2, 19); (4, 35); y increases by 8
Reasoning Substitute each input into y = 8x + 3; x is horizontal and y vertical.

8. (0, 6); (1, 14); (2, 22); (6, 54); y increases by 8
Reasoning Substitute each input into y = 8x + 6; x is horizontal and y vertical.

9. (0, 6); (1, 10); (2, 14); (4, 22); y increases by 4
Reasoning Substitute each input into y = 4x + 6; x is horizontal and y vertical.

10. (0, 2); (1, 8); (2, 14); (6, 38); y increases by 6
Reasoning Substitute each input into y = 6x + 2; x is horizontal and y vertical.

Unit 7 Test

Equations Inequalities and Relationships

1. 16
Reasoning Use parentheses and exponents first, then × and ÷ left to right, then + and -. Result: 16.

2. n - 5
Reasoning Start with n, then subtract the named amount.

3. 46
Reasoning Substitute first: 7 × 6 + 4 = 46.

4. Yes; distribution gives 7x + 49
Reasoning 7(x + 7) = 7x + 49. This matches.

5. No; left side = 51
Reasoning 8 × 6 + 3 = 51; compare with 43.

6. x = 3
Reasoning Subtract 4 on both sides. Then x = 3; substitution gives 7 on each side.

7. x = 3
Reasoning Add 2 on both sides. Then x = 3; substitution gives 1 on each side.

8. x = 5/2
Reasoning Divide by 2 on both sides. Then x = 5/2; substitution gives 5 on each side.

9. x = 3
Reasoning Multiply by 5 on both sides. Then x = 3; substitution gives 3/5 on each side.

10. 7x = 42; x = 6 m
Reasoning Divide the total by 7: 42 ÷ 7 = 6.

11. x < 35; open circle at 35, shade left
Reasoning “less than” means <; exclude the endpoint.

12. 7, 8
Reasoning Values below 8 work; the endpoint works too.

13. x < 9; open circle at 9, shade left
Reasoning “less than” means <; exclude the endpoint.

14. Independent n = notebooks; dependent C = cost; C = 3n + 6; C(0) = $6, the fee
Reasoning The chosen notebook count is the input; multiply it by price and add any fixed fee to get the cost.

15. (0, 5); (1, 10); (2, 15); (4, 25); y increases by 5
Reasoning Substitute each input into y = 5x + 5; x is horizontal and y vertical.

16. (0, 5); (1, 9); (2, 13); (3, 17); y increases by 4
Reasoning Substitute each input into y = 4x + 5; x is horizontal and y vertical.

17. Yes; left side = 35
Reasoning 7 × 4 + 7 = 35; compare with 35.

18. x = 7/2
Reasoning Subtract 3/2 on both sides. Then x = 7/2; substitution gives 5 on each side.

19. x = 3
Reasoning Add 5/2 on both sides. Then x = 3; substitution gives 1/2 on each side.

20. x = 7/2
Reasoning Divide by 1 on both sides. Then x = 7/2; substitution gives 7/2 on each side.

Triangle Areas by Decomposition

Area Volume and Surface Area

1. 6 cm²
Reasoning A = bh/2 = 6 × 2 ÷ 2 = 6. Two such triangles make a parallelogram.

2. 36 cm²
Reasoning A = bh/2 = 12 × 6 ÷ 2 = 36. Two such triangles make a parallelogram.

3. 15 cm²
Reasoning A = bh/2 = 10 × 3 ÷ 2 = 15. Two such triangles make a parallelogram.

4. 10 cm²
Reasoning A = bh/2 = 4 × 5 ÷ 2 = 10. Two such triangles make a parallelogram.

5. 4 cm²
Reasoning A = bh/2 = 4 × 2 ÷ 2 = 4. Two such triangles make a parallelogram.

6. 42 cm²
Reasoning A = bh/2 = 14 × 6 ÷ 2 = 42. Two such triangles make a parallelogram.

7. 9 cm²
Reasoning A = bh/2 = 6 × 3 ÷ 2 = 9. Two such triangles make a parallelogram.

8. 4 cm²
Reasoning A = bh/2 = 4 × 2 ÷ 2 = 4. Two such triangles make a parallelogram.

9. 12 cm²
Reasoning A = bh/2 = 12 × 2 ÷ 2 = 12. Two such triangles make a parallelogram.

10. 18 cm²
Reasoning A = bh/2 = 12 × 3 ÷ 2 = 18. Two such triangles make a parallelogram.

Triangle Heights and Fractional Measures

Area Volume and Surface Area

1. 14 cm²
Reasoning A = bh/2 = 4 × 7 ÷ 2 = 14. Two such triangles make a parallelogram.

2. 6 cm²
Reasoning A = bh/2 = 4 × 3 ÷ 2 = 6. Two such triangles make a parallelogram.

3. 56 cm²
Reasoning A = bh/2 = 16 × 7 ÷ 2 = 56. Two such triangles make a parallelogram.

4. 12 cm²
Reasoning A = bh/2 = 4 × 6 ÷ 2 = 12. Two such triangles make a parallelogram.

5. 35 cm²
Reasoning A = bh/2 = 10 × 7 ÷ 2 = 35. Two such triangles make a parallelogram.

6. 8 cm²
Reasoning A = bh/2 = 4 × 4 ÷ 2 = 8. Two such triangles make a parallelogram.

7. 8 cm²
Reasoning A = bh/2 = 8 × 2 ÷ 2 = 8. Two such triangles make a parallelogram.

8. 35/2 cm²
Reasoning A = bh/2 = 14 × 5/2 ÷ 2 = 35/2. Two such triangles make a parallelogram.

9. 10 cm²
Reasoning A = bh/2 = 10 × 2 ÷ 2 = 10. Two such triangles make a parallelogram.

10. 4 cm²
Reasoning A = bh/2 = 8 × 1 ÷ 2 = 4. Two such triangles make a parallelogram.

Parallelograms and Trapezoids

Area Volume and Surface Area

1. 12 m²
Reasoning Cut and shift a corner; A = bh = 3 × 4 = 12.

2. 35 m²
Reasoning Cut and shift a corner; A = bh = 7 × 5 = 35.

3. 8 m²
Reasoning Cut and shift a corner; A = bh = 2 × 4 = 8.

4. 48 m²
Reasoning A = (10 + 22) × 3 ÷ 2 = 48.

5. 105 m²
Reasoning A = (10 + 20) × 7 ÷ 2 = 105.

6. 36 m²
Reasoning A = (6 + 18) × 3 ÷ 2 = 36.

7. 85 m²
Reasoning A = (12 + 22) × 5 ÷ 2 = 85.

8. 35 m²
Reasoning A = (4 + 10) × 5 ÷ 2 = 35.

9. 132 m²
Reasoning A = (16 + 28) × 6 ÷ 2 = 132.

10. 72 m²
Reasoning A = (12 + 24) × 4 ÷ 2 = 72.

Composite Polygon Areas

Area Volume and Surface Area

1. 102 m²
Reasoning Outer area 126 minus cutout 24 = 102.

2. 56 m²
Reasoning Outer area 80 minus cutout 24 = 56.

3. 90 m²
Reasoning Outer area 104 minus cutout 14 = 90.

4. 102 m²
Reasoning Outer area 130 minus cutout 28 = 102.

5. 14 m²
Reasoning Outer area 20 minus cutout 6 = 14.

6. 56 m²
Reasoning Outer area 77 minus cutout 21 = 56.

7. 20 m²
Reasoning Whole rectangle 24; remove triangle 4; difference 20.

8. 108 m²
Reasoning Whole rectangle 117; remove triangle 9; difference 108.

9. 98 m²
Reasoning Whole rectangle 104; remove triangle 6; difference 98.

10. 42 m²
Reasoning Whole rectangle 48; remove triangle 6; difference 42.

Quiz 1

Area Volume and Surface Area

1. x = 4
Reasoning Subtract 5 on both sides. Then x = 4; substitution gives 9 on each side.

2. 32 cm²
Reasoning A = bh/2 = 16 × 4 ÷ 2 = 32. Two such triangles make a parallelogram.

3. 16 cm²
Reasoning A = bh/2 = 16 × 2 ÷ 2 = 16. Two such triangles make a parallelogram.

4. 63 m²
Reasoning A = (6 + 12) × 7 ÷ 2 = 63.

5. 27 m²
Reasoning Whole rectangle 30; remove triangle 3; difference 27.

Polygons on the Coordinate Plane

Area Volume and Surface Area

1. Sides 10 and 12; area 120 square units
Reasoning Horizontal length 10 - (0) = 10; vertical length 12 - (0) = 12; area = 10 × 12.

2. Sides 11 and 8; area 88 square units
Reasoning Horizontal length 11 - (0) = 11; vertical length 8 - (0) = 8; area = 11 × 8.

3. Sides 6 and 10; area 60 square units
Reasoning Horizontal length 6 - (0) = 6; vertical length 10 - (0) = 10; area = 6 × 10.

4. Sides 4 and 6; area 24 square units
Reasoning Horizontal length 2 - (-2) = 4; vertical length 2 - (-4) = 6; area = 4 × 6.

5. Sides 5 and 9; area 45 square units
Reasoning Horizontal length 2 - (-3) = 5; vertical length 2 - (-7) = 9; area = 5 × 9.

6. Sides 11 and 5; area 55 square units
Reasoning Horizontal length 3 - (-8) = 11; vertical length 3 - (-2) = 5; area = 11 × 5.

7. Sides 10 and 12; area 120 square units; perimeter 44 units
Reasoning Horizontal length 5 - (-5) = 10; vertical length 5 - (-7) = 12; area = 10 × 12.

8. Sides 11 and 10; area 110 square units; perimeter 42 units
Reasoning Horizontal length 6 - (-5) = 11; vertical length 6 - (-4) = 10; area = 11 × 10.

9. Sides 10 and 7; area 70 square units; perimeter 34 units
Reasoning Horizontal length 2 - (-8) = 10; vertical length 2 - (-5) = 7; area = 10 × 7.

10. Sides 5 and 4; area 20 square units; perimeter 18 units
Reasoning Horizontal length 2 - (-3) = 5; vertical length 2 - (-2) = 4; area = 5 × 4.

Volume with Fractional Edges

Area Volume and Surface Area

1. 105/2 cm³
Reasoning B = 7 × 3/2 = 21/2 cm²; V = B × 5 = 105/2 cm³.

2. 25 cm³
Reasoning B = 2 × 5/2 = 5 cm²; V = B × 5 = 25 cm³.

3. 15 cm³
Reasoning B = 3 × 1 = 3 cm²; V = B × 5 = 15 cm³.

4. 75/4 cm³
Reasoning B = 3/2 × 5/2 = 15/4 cm²; V = B × 5 = 75/4 cm³.

5. 8 cm³
Reasoning B = 2 × 2 = 4 cm²; V = B × 2 = 8 cm³.

6. 18 cm³
Reasoning B = 3 × 1 = 3 cm²; V = B × 6 = 18 cm³.

7. 15/4 cm³
Reasoning B = 3/2 × 5/2 = 15/4 cm²; V = B × 1 = 15/4 cm³.

8. 3 cm³
Reasoning B = 1 × 3 = 3 cm²; V = B × 1 = 3 cm³.

9. 21/2 cm³
Reasoning B = 7/2 × 2 = 7 cm²; V = B × 3/2 = 21/2 cm³.

10. 105/4 cm³
Reasoning B = 7/2 × 3 = 21/2 cm²; V = B × 5/2 = 105/4 cm³.

Base Area and Prism Volume

Area Volume and Surface Area

1. 36 cm³
Reasoning B = 3 × 2 = 6 cm²; V = B × 6 = 36 cm³.

2. 28 cm³
Reasoning B = 4 × 7/2 = 14 cm²; V = B × 2 = 28 cm³.

3. 120 cm³
Reasoning B = 8 × 3 = 24 cm²; V = B × 5 = 120 cm³.

4. 75/2 cm³
Reasoning B = 5/2 × 3 = 15/2 cm²; V = B × 5 = 75/2 cm³.

5. 18 cm³
Reasoning B = 1 × 3 = 3 cm²; V = B × 6 = 18 cm³.

6. 27 cm³
Reasoning B = 3 × 3/2 = 9/2 cm²; V = B × 6 = 27 cm³.

7. 8 cm³
Reasoning B = 2 × 2 = 4 cm²; V = B × 2 = 8 cm³.

8. 6 cm³
Reasoning B = 2 × 1 = 2 cm²; V = B × 3 = 6 cm³.

9. 6 cm³
Reasoning B = 2 × 3 = 6 cm²; V = B × 1 = 6 cm³.

10. 12 cm³
Reasoning B = 3 × 2 = 6 cm²; V = B × 2 = 12 cm³.

Packing Fractional Unit Cubes

Area Volume and Surface Area

1. 126 cubes; each 1/8 cubic unit; prism 63/4 cubic units
Reasoning Counts along edges: 6, 7, 3. Product 126; 126 × 1/8 = 63/4, also lwh.

2. 80 cubes; each 1/8 cubic unit; prism 10 cubic units
Reasoning Counts along edges: 8, 2, 5. Product 80; 80 × 1/8 = 10, also lwh.

3. 72 cubes; each 1/8 cubic unit; prism 9 cubic units
Reasoning Counts along edges: 8, 3, 3. Product 72; 72 × 1/8 = 9, also lwh.

4. 112 cubes; each 1/8 cubic unit; prism 14 cubic units
Reasoning Counts along edges: 8, 7, 2. Product 112; 112 × 1/8 = 14, also lwh.

5. 75 cubes; each 1/8 cubic unit; prism 75/8 cubic units
Reasoning Counts along edges: 5, 5, 3. Product 75; 75 × 1/8 = 75/8, also lwh.

6. 60 cubes; each 1/8 cubic unit; prism 15/2 cubic units
Reasoning Counts along edges: 2, 6, 5. Product 60; 60 × 1/8 = 15/2, also lwh.

7. 24 cubes; each 1/27 cubic unit; prism 8/9 cubic units
Reasoning Counts along edges: 2, 2, 6. Product 24; 24 × 1/27 = 8/9, also lwh.

8. 105 cubes; each 1/27 cubic unit; prism 35/9 cubic units
Reasoning Counts along edges: 7, 3, 5. Product 105; 105 × 1/27 = 35/9, also lwh.

9. 16 cubes; each 1/27 cubic unit; prism 16/27 cubic units
Reasoning Counts along edges: 4, 2, 2. Product 16; 16 × 1/27 = 16/27, also lwh.

10. 48 cubes; each 1/27 cubic unit; prism 16/9 cubic units
Reasoning Counts along edges: 2, 6, 4. Product 48; 48 × 1/27 = 16/9, also lwh.

Quiz 2

Area Volume and Surface Area

1. 8, 9
Reasoning Values below 9 work; the endpoint works too.

2. Sides 6 and 6; area 36 square units
Reasoning Horizontal length 4 - (-2) = 6; vertical length 4 - (-2) = 6; area = 6 × 6.

3. 27/4 cm³
Reasoning B = 3/2 × 3/2 = 9/4 cm²; V = B × 3 = 27/4 cm³.

4. 27/2 cm³
Reasoning B = 3 × 3 = 9 cm²; V = B × 3/2 = 27/2 cm³.

5. 144 cubes; each 1/27 cubic unit; prism 16/3 cubic units
Reasoning Counts along edges: 4, 6, 6. Product 144; 144 × 1/27 = 16/3, also lwh.

Drawing and Labeling Nets

Area Volume and Surface Area

1. 2 faces each of 5×5, 5×4, 5×4; 130 cm²
Reasoning Add 2(25) + 2(20) + 2(20) = 130.

2. 2 faces each of 3×3, 3×2, 3×2; 42 cm²
Reasoning Add 2(9) + 2(6) + 2(6) = 42.

3. 2 faces each of 7×3, 7×3, 3×3; 102 cm²
Reasoning Add 2(21) + 2(21) + 2(9) = 102.

4. 2 faces each of 2×4, 2×3, 4×3; 52 cm²
Reasoning Add 2(8) + 2(6) + 2(12) = 52.

5. 2 faces each of 2×2, 2×4, 2×4; 40 cm²
Reasoning Add 2(4) + 2(8) + 2(8) = 40.

6. 2 faces each of 6×7, 6×2, 7×2; 136 cm²
Reasoning Add 2(42) + 2(12) + 2(14) = 136.

7. 2 triangles (area 6 each), rectangles 3×5, 4×5, 5×5; SA 72 cm²
Reasoning Triangle pair: 12 cm²; rectangles: (3+4+5) × 5 = 60; total 72.

8. 2 triangles (area 6 each), rectangles 3×4, 4×4, 5×4; SA 60 cm²
Reasoning Triangle pair: 12 cm²; rectangles: (3+4+5) × 4 = 48; total 60.

9. 2 triangles (area 6 each), rectangles 3×8, 4×8, 5×8; SA 108 cm²
Reasoning Triangle pair: 12 cm²; rectangles: (3+4+5) × 8 = 96; total 108.

10. 2 triangles (area 6 each), rectangles 3×3, 4×3, 5×3; SA 48 cm²
Reasoning Triangle pair: 12 cm²; rectangles: (3+4+5) × 3 = 36; total 48.

Prism Surface Area

Area Volume and Surface Area

1. 184 cm²
Reasoning Closed surface area = 2(32+40+20) = 184.

2. 214 cm²
Reasoning Closed surface area = 2(35+42+30) = 214.

3. 104 cm²
Reasoning Closed surface area = 2(10+12+30) = 104.

4. 144 cm²
Reasoning Closed surface area = 2(28+16+28) = 144.

5. 160 cm²
Reasoning Closed surface area = 2(32+32+16) = 160.

6. 24 cm²
Reasoning Closed surface area = 2(4+4+4) = 24.

7. 104 cm²
Reasoning Closed surface area = 2(24+16+24) = 128. Remove the top area 24: 104.

8. 84 cm²
Reasoning Closed surface area = 2(36+12+12) = 120. Remove the top area 36: 84.

9. 161 cm²
Reasoning Closed surface area = 2(49+28+28) = 210. Remove the top area 49: 161.

10. 170 cm²
Reasoning Closed surface area = 2(40+40+25) = 210. Remove the top area 40: 170.

Pyramid Nets and Surface Area

Area Volume and Surface Area

1. 96 cm²
Reasoning Base = 36; each triangle = 6 × 5 ÷ 2 = 15; add four triangles to get 96.

2. 80 cm²
Reasoning Base = 16; each triangle = 4 × 8 ÷ 2 = 16; add four triangles to get 80.

3. 64 cm²
Reasoning Base = 16; each triangle = 4 × 6 ÷ 2 = 12; add four triangles to get 64.

4. 280 cm²
Reasoning Base = 100; each triangle = 10 × 9 ÷ 2 = 45; add four triangles to get 280.

5. 560 cm²
Reasoning Base = 196; each triangle = 14 × 13 ÷ 2 = 91; add four triangles to get 560.

6. 132 cm²
Reasoning Base = 36; each triangle = 6 × 8 ÷ 2 = 24; add four triangles to get 132.

7. 336 cm²
Reasoning Base = 144; each triangle = 12 × 8 ÷ 2 = 48; add four triangles to get 336.

8. 360 cm²
Reasoning Base = 144; each triangle = 12 × 9 ÷ 2 = 54; add four triangles to get 360.

9. 300 cm²
Reasoning Base = 100; each triangle = 10 × 10 ÷ 2 = 50; add four triangles to get 300.

10. 560 cm²
Reasoning Base = 196; each triangle = 14 × 13 ÷ 2 = 91; add four triangles to get 560.

Choosing Area Volume or Surface Area

Area Volume and Surface Area

1. 24 cm²
Reasoning A = bh/2 = 16 × 3 ÷ 2 = 24. Two such triangles make a parallelogram.

2. 30 cm³
Reasoning B = 6 × 1 = 6 cm²; V = B × 5 = 30 cm³.

3. 56 cm²
Reasoning Closed surface area = 2(12+12+4) = 56.

4. 72 m²
Reasoning Outer area 121 minus cutout 49 = 72.

5. 176 cm²
Reasoning Base = 64; each triangle = 8 × 7 ÷ 2 = 28; add four triangles to get 176.

6. 8 cm²
Reasoning A = bh/2 = 8 × 2 ÷ 2 = 8. Two such triangles make a parallelogram.

7. 75/4 cm³
Reasoning B = 5/2 × 5/2 = 25/4 cm²; V = B × 3 = 75/4 cm³.

8. 94 cm²
Reasoning Closed surface area = 2(28+12+21) = 122. Remove the top area 28: 94.

9. 71 m²
Reasoning Whole rectangle 77; remove triangle 6; difference 71.

10. 476 cm²
Reasoning Base = 196; each triangle = 14 × 10 ÷ 2 = 70; add four triangles to get 476.

Unit 8 Test

Area Volume and Surface Area

1. x = 19/2
Reasoning Add 7 on both sides. Then x = 19/2; substitution gives 5/2 on each side.

2. x + 8 = 32; x = 24 cards
Reasoning Subtract 8 from both sides; 24 + 8 = 32.

3. x < 16; open circle at 16, shade left
Reasoning “less than” means <; exclude the endpoint.

4. (0, 4); (1, 10); (2, 16); (6, 40)
Reasoning Substitute each input into y = 6x + 4; x is horizontal and y vertical.

5. 30 cm²
Reasoning A = bh/2 = 10 × 6 ÷ 2 = 30. Two such triangles make a parallelogram.

6. 10 cm²
Reasoning A = bh/2 = 10 × 2 ÷ 2 = 10. Two such triangles make a parallelogram.

7. 9 m²
Reasoning Cut and shift a corner; A = bh = 3 × 3 = 9.

8. 30 m²
Reasoning Outer area 72 minus cutout 42 = 30.

9. Sides 10 and 8; area 80 square units
Reasoning Horizontal length 2 - (-8) = 10; vertical length 2 - (-6) = 8; area = 10 × 8.

10. 40 cm³
Reasoning B = 4 × 2 = 8 cm²; V = B × 5 = 40 cm³.

11. 20 cm³
Reasoning B = 4 × 5/2 = 10 cm²; V = B × 2 = 20 cm³.

12. 48 cubes; each 1/8 cubic unit; prism 6 cubic units
Reasoning Counts along edges: 4, 4, 3. Product 48; 48 × 1/8 = 6, also lwh.

13. 2 faces each of 2×3, 2×4, 3×4; 52 cm²
Reasoning Add 2(6) + 2(8) + 2(12) = 52.

14. 80 cm²
Reasoning Closed surface area = 2(10+25+10) = 90. Remove the top area 10: 80.

15. 432 cm²
Reasoning Base = 144; each triangle = 12 × 12 ÷ 2 = 72; add four triangles to get 432.

16. 116 cm²
Reasoning Closed surface area = 2(28+16+28) = 144. Remove the top area 28: 116.

17. 14 cm²
Reasoning A = bh/2 = 14 × 2 ÷ 2 = 14. Two such triangles make a parallelogram.

18. 21/2 cm²
Reasoning A = bh/2 = 6 × 7/2 ÷ 2 = 21/2. Two such triangles make a parallelogram.

19. 56 m²
Reasoning A = (8 + 20) × 4 ÷ 2 = 56.

20. 155/2 m²
Reasoning Whole rectangle 90; remove triangle 25/2; difference 155/2.

Questions That Anticipate Variability

Statistics and Data Displays

1. Yes; pages read vary across students.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

2. No; one fixed conversion, 100 cm.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

3. Yes; plant heights vary.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

4. Group: class; attribute: sleep duration; units: minutes.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

5. Example: What are the lengths in centimeters of the pencils in our classroom?
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

6. It seeks one fixed value, rather than anticipating variation in a data collection.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

7. Example: How many minutes do students in our class take to reach school? Group: class; travel time in minutes varies with routes and travel methods.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

8. Example: On a 1 to 5 scale, how do students in our class rate the school library? Ratings vary among students; the numerical scale must be defined.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

9. Example: How many liters of water do students in our class drink in one day? Record each student’s total over the same 24-hour period in liters; amounts can differ.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

10. Counterexample: How many sides does a triangle have? It has a fixed answer. A statistical question anticipates variability in a collection of data.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

Center Spread and Shape

Statistics and Data Displays

1. Center near 13/2 min; range 3 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 8 - 5.

2. Center near 11/2 min; range 3 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 7 - 4.

3. Center near 19/2 min; range 3 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 11 - 8.

4. Center near 23/2 min; range 15 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 19 - 4.

5. Center near 8 min; range 12 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 14 - 2.

6. Center near 7 min; range 6 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 10 - 4.

7. Center near 17/2 min; range 12 min; right-skewed with high value 19 min
Reasoning The values cluster low with a long high tail. Range = 19 - 7.

8. Center near 19/2 min; range 12 min; right-skewed with high value 20 min
Reasoning The values cluster low with a long high tail. Range = 20 - 8.

9. Center near 11/2 min; range 12 min; right-skewed with high value 16 min
Reasoning The values cluster low with a long high tail. Range = 16 - 4.

10. Center near 7/2 min; range 12 min; right-skewed with high value 14 min
Reasoning The values cluster low with a long high tail. Range = 14 - 2.

Mean and Observation Counts

Statistics and Data Displays

1. n = 6; minutes; mean 9/2 min
Reasoning Sum = 27; mean = 27 ÷ 6 = 9/2.

2. n = 6; minutes; mean 7/2 min
Reasoning Sum = 21; mean = 21 ÷ 6 = 7/2.

3. n = 6; minutes; mean 17/2 min
Reasoning Sum = 51; mean = 51 ÷ 6 = 17/2.

4. n = 6; minutes; mean 12 min
Reasoning Sum = 72; mean = 72 ÷ 6 = 12.

5. n = 6; minutes; mean 17 min
Reasoning Sum = 102; mean = 102 ÷ 6 = 17.

6. n = 6; minutes; mean 23/2 min
Reasoning Sum = 69; mean = 69 ÷ 6 = 23/2.

7. n = 6; minutes; mean 37/6 min; new mean 44/7 min
Reasoning Sum = 37; mean = 37 ÷ 6 = 37/6. New sum = 44; divide by 7.

8. n = 6; minutes; mean 67/6 min; new mean 79/7 min
Reasoning Sum = 67; mean = 67 ÷ 6 = 67/6. New sum = 79; divide by 7.

9. n = 6; minutes; mean 43/6 min; new mean 51/7 min
Reasoning Sum = 43; mean = 43 ÷ 6 = 43/6. New sum = 51; divide by 7.

10. n = 6; minutes; mean 55/6 min; new mean 65/7 min
Reasoning Sum = 55; mean = 55 ÷ 6 = 55/6. New sum = 65; divide by 7.

Medians and Unusual Values

Statistics and Data Displays

1. Median 11/2 min
Reasoning 6 ordered values: average positions 3 and 4: (5 + 6) ÷ 2 = 11/2.

2. Median 9/2 min
Reasoning 6 ordered values: average positions 3 and 4: (4 + 5) ÷ 2 = 9/2.

3. Median 7/2 min
Reasoning 6 ordered values: average positions 3 and 4: (3 + 4) ÷ 2 = 7/2.

4. Median 11 min
Reasoning 6 ordered values: average positions 3 and 4: (10 + 12) ÷ 2 = 11.

5. Median 10 min
Reasoning 6 ordered values: average positions 3 and 4: (8 + 12) ÷ 2 = 10.

6. Median 19/2 min
Reasoning 6 ordered values: average positions 3 and 4: (7 + 12) ÷ 2 = 19/2.

7. Median 15/2 min; mean 55/6 min; the high value pulls the mean upward
Reasoning 6 ordered values: average positions 3 and 4: (7 + 8) ÷ 2 = 15/2.

8. Median 11/2 min; mean 43/6 min; the high value pulls the mean upward
Reasoning 6 ordered values: average positions 3 and 4: (5 + 6) ÷ 2 = 11/2.

9. Median 9/2 min; mean 37/6 min; the high value pulls the mean upward
Reasoning 6 ordered values: average positions 3 and 4: (4 + 5) ÷ 2 = 9/2.

10. Median 19/2 min; mean 67/6 min; the high value pulls the mean upward
Reasoning 6 ordered values: average positions 3 and 4: (9 + 10) ÷ 2 = 19/2.

Quiz 1

Statistics and Data Displays

1. 35 cm²
Reasoning A = bh/2 = 14 × 5 ÷ 2 = 35. Two such triangles make a parallelogram.

2. Group: class; attribute: sleep duration; units: minutes.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

3. Center near 17/2 min; range 9 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 13 - 4.

4. n = 6; minutes; mean 61/6 min; new mean 72/7 min
Reasoning Sum = 61; mean = 61 ÷ 6 = 61/6. New sum = 72; divide by 7.

5. Median 17/2 min; mean 61/6 min; the high value pulls the mean upward
Reasoning 6 ordered values: average positions 3 and 4: (8 + 9) ÷ 2 = 17/2.

Quartiles and Interquartile Range

Statistics and Data Displays

1. Q1 3, Q3 4; IQR 1 min; range 3 min
Reasoning Lower half [2, 3, 3] has median 3; upper half [4, 4, 5] has median 4. Subtract Q1 from Q3.

2. Q1 7, Q3 8; IQR 1 min; range 3 min
Reasoning Lower half [6, 7, 7] has median 7; upper half [8, 8, 9] has median 8. Subtract Q1 from Q3.

3. Q1 9, Q3 10; IQR 1 min; range 3 min
Reasoning Lower half [8, 9, 9] has median 9; upper half [10, 10, 11] has median 10. Subtract Q1 from Q3.

4. Q1 8, Q3 13; IQR 5 min; range 15 min
Reasoning Lower half [3, 8, 8] has median 8; upper half [13, 13, 18] has median 13. Subtract Q1 from Q3.

5. Q1 8, Q3 11; IQR 3 min; range 9 min
Reasoning Lower half [5, 8, 8] has median 8; upper half [11, 11, 14] has median 11. Subtract Q1 from Q3.

6. Q1 7, Q3 9; IQR 2 min; range 6 min
Reasoning Lower half [5, 7, 7] has median 7; upper half [9, 9, 11] has median 9. Subtract Q1 from Q3.

7. Q1 3, Q3 5; IQR 2 min; range 12 min; IQR is the span of the middle half
Reasoning Lower half [2, 3, 3] has median 3; upper half [4, 5, 14] has median 5. Subtract Q1 from Q3.

8. Q1 6, Q3 8; IQR 2 min; range 12 min; IQR is the span of the middle half
Reasoning Lower half [5, 6, 6] has median 6; upper half [7, 8, 17] has median 8. Subtract Q1 from Q3.

9. Q1 8, Q3 10; IQR 2 min; range 12 min; IQR is the span of the middle half
Reasoning Lower half [7, 8, 8] has median 8; upper half [9, 10, 19] has median 10. Subtract Q1 from Q3.

10. Q1 9, Q3 11; IQR 2 min; range 12 min; IQR is the span of the middle half
Reasoning Lower half [8, 9, 9] has median 9; upper half [10, 11, 20] has median 11. Subtract Q1 from Q3.

Mean Absolute Deviation

Statistics and Data Displays

1. Mean 19/2 min; MAD 5/6 min
Reasoning Distances: 3/2, 1/2, 1/2, 1/2, 1/2, 3/2; sum 5; divide by 6 = 5/6.

2. Mean 17/2 min; MAD 5/6 min
Reasoning Distances: 3/2, 1/2, 1/2, 1/2, 1/2, 3/2; sum 5; divide by 6 = 5/6.

3. Mean 7/2 min; MAD 5/6 min
Reasoning Distances: 3/2, 1/2, 1/2, 1/2, 1/2, 3/2; sum 5; divide by 6 = 5/6.

4. Mean 11 min; MAD 5/3 min
Reasoning Distances: 3, 1, 1, 1, 1, 3; sum 10; divide by 6 = 5/3.

5. Mean 14 min; MAD 10/3 min
Reasoning Distances: 6, 2, 2, 2, 2, 6; sum 20; divide by 6 = 10/3.

6. Mean 7 min; MAD 5/3 min
Reasoning Distances: 3, 1, 1, 1, 1, 3; sum 10; divide by 6 = 5/3.

7. Mean 43/6 min; MAD 53/18 min; a typical distance from the mean is 53/18 min
Reasoning Distances: 19/6, 13/6, 13/6, 7/6, 1/6, 53/6; sum 53/3; divide by 6 = 53/18.

8. Mean 37/6 min; MAD 53/18 min; a typical distance from the mean is 53/18 min
Reasoning Distances: 19/6, 13/6, 13/6, 7/6, 1/6, 53/6; sum 53/3; divide by 6 = 53/18.

9. Mean 31/6 min; MAD 53/18 min; a typical distance from the mean is 53/18 min
Reasoning Distances: 19/6, 13/6, 13/6, 7/6, 1/6, 53/6; sum 53/3; divide by 6 = 53/18.

10. Mean 61/6 min; MAD 53/18 min; a typical distance from the mean is 53/18 min
Reasoning Distances: 19/6, 13/6, 13/6, 7/6, 1/6, 53/6; sum 53/3; divide by 6 = 53/18.

Choosing Measures of Center

Statistics and Data Displays

1. Mean 11/2 min and MAD 5/6 min; roughly symmetric data
Reasoning Mean = 11/2, median = 11/2, IQR = 6 - 5 = 1, MAD = 5/6. Accept another justified choice tied to shape and purpose.

2. Mean 9/2 min and MAD 5/6 min; roughly symmetric data
Reasoning Mean = 9/2, median = 9/2, IQR = 5 - 4 = 1, MAD = 5/6. Accept another justified choice tied to shape and purpose.

3. Mean 19/2 min and MAD 5/6 min; roughly symmetric data
Reasoning Mean = 19/2, median = 19/2, IQR = 10 - 9 = 1, MAD = 5/6. Accept another justified choice tied to shape and purpose.

4. Mean 11 min and MAD 10/3 min; roughly symmetric data
Reasoning Mean = 11, median = 11, IQR = 13 - 9 = 4, MAD = 10/3. Accept another justified choice tied to shape and purpose.

5. Mean 23/2 min and MAD 25/6 min; roughly symmetric data
Reasoning Mean = 23/2, median = 23/2, IQR = 14 - 9 = 5, MAD = 25/6. Accept another justified choice tied to shape and purpose.

6. Mean 11 min and MAD 5/3 min; roughly symmetric data
Reasoning Mean = 11, median = 11, IQR = 12 - 10 = 2, MAD = 5/3. Accept another justified choice tied to shape and purpose.

7. Median 13/2 min and IQR 2 min; high value makes these resistant measures useful
Reasoning Mean = 49/6, median = 13/2, IQR = 8 - 6 = 2, MAD = 53/18. Accept another justified choice tied to shape and purpose.

8. Median 15/2 min and IQR 2 min; high value makes these resistant measures useful
Reasoning Mean = 55/6, median = 15/2, IQR = 9 - 7 = 2, MAD = 53/18. Accept another justified choice tied to shape and purpose.

9. Median 9/2 min and IQR 2 min; high value makes these resistant measures useful
Reasoning Mean = 37/6, median = 9/2, IQR = 6 - 4 = 2, MAD = 53/18. Accept another justified choice tied to shape and purpose.

10. Median 11/2 min and IQR 2 min; high value makes these resistant measures useful
Reasoning Mean = 43/6, median = 11/2, IQR = 7 - 5 = 2, MAD = 53/18. Accept another justified choice tied to shape and purpose.

Dot Plots on a Number Line

Statistics and Data Displays

1. 8: 1 dot; 9: 2 dots; 10: 2 dots; 11: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

2. 3: 1 dot; 4: 2 dots; 5: 2 dots; 6: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

3. 6: 1 dot; 7: 2 dots; 8: 2 dots; 9: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

4. 2: 1 dot; 6: 2 dots; 10: 2 dots; 14: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

5. 8: 1 dot; 11: 2 dots; 14: 2 dots; 17: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

6. 3: 1 dot; 6: 2 dots; 9: 2 dots; 12: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

7. 6: 1 dot; 7: 2 dots; 8: 1 dot; 9: 1 dot; 18: 1 dot; n = 6; low cluster and high isolated value
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

8. 3: 1 dot; 4: 2 dots; 5: 1 dot; 6: 1 dot; 15: 1 dot; n = 6; low cluster and high isolated value
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

9. 2: 1 dot; 3: 2 dots; 4: 1 dot; 5: 1 dot; 14: 1 dot; n = 6; low cluster and high isolated value
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

10. 4: 1 dot; 5: 2 dots; 6: 1 dot; 7: 1 dot; 16: 1 dot; n = 6; low cluster and high isolated value
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

Quiz 2

Statistics and Data Displays

1. 45 cubes; each 1/8 cubic unit; prism 45/8 cubic units
Reasoning Counts along edges: 5, 3, 3. Product 45; 45 × 1/8 = 45/8, also lwh.

2. Q1 9, Q3 12; IQR 3 min; range 9 min
Reasoning Lower half [6, 9, 9] has median 9; upper half [12, 12, 15] has median 12. Subtract Q1 from Q3.

3. Mean 8 min; MAD 5/3 min
Reasoning Distances: 3, 1, 1, 1, 1, 3; sum 10; divide by 6 = 5/3.

4. Median 17/2 min and IQR 2 min; high value makes these resistant measures useful
Reasoning Mean = 61/6, median = 17/2, IQR = 10 - 8 = 2, MAD = 53/18. Accept another justified choice tied to shape and purpose.

5. 5: 1 dot; 6: 2 dots; 7: 1 dot; 8: 1 dot; 17: 1 dot; n = 6; low cluster and high isolated value
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

Histograms and Intervals

Statistics and Data Displays

1. Frequencies 0, 3, 3, 0
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

2. Frequencies 1, 2, 3, 0
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

3. Frequencies 1, 2, 1, 2
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

4. Frequencies 3, 1, 2, 4
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

5. Frequencies 5, 0, 3, 2
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

6. Frequencies 5, 2, 2, 1
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

7. Frequencies 1, 2, 3, 4; greatest: 15–19
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

8. Frequencies 1, 7, 0, 2; greatest: 5–9
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

9. Frequencies 2, 1, 6, 1; greatest: 10–14
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

10. Frequencies 2, 3, 2, 3; greatest: 5–9, 15–19
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

Box Plots and Five Number Summaries

Statistics and Data Displays

1. (8, 9, 19/2, 10, 11)
Reasoning Box runs from 9 to 10, median line at 19/2, whiskers to 8 and 11.

2. (4, 5, 11/2, 6, 7)
Reasoning Box runs from 5 to 6, median line at 11/2, whiskers to 4 and 7.

3. (6, 7, 15/2, 8, 9)
Reasoning Box runs from 7 to 8, median line at 15/2, whiskers to 6 and 9.

4. (2, 5, 13/2, 8, 11)
Reasoning Box runs from 5 to 8, median line at 13/2, whiskers to 2 and 11.

5. (2, 6, 8, 10, 14)
Reasoning Box runs from 6 to 10, median line at 8, whiskers to 2 and 14.

6. (8, 11, 25/2, 14, 17)
Reasoning Box runs from 11 to 14, median line at 25/2, whiskers to 8 and 17.

7. (7, 8, 17/2, 10, 19); IQR 2 min
Reasoning Box runs from 8 to 10, median line at 17/2, whiskers to 7 and 19.

8. (5, 6, 13/2, 8, 17); IQR 2 min
Reasoning Box runs from 6 to 8, median line at 13/2, whiskers to 5 and 17.

9. (8, 9, 19/2, 11, 20); IQR 2 min
Reasoning Box runs from 9 to 11, median line at 19/2, whiskers to 8 and 20.

10. (3, 4, 9/2, 6, 15); IQR 2 min
Reasoning Box runs from 4 to 6, median line at 9/2, whiskers to 3 and 15.

Comparing Data Sets

Statistics and Data Displays

1. A median 7/2, B median 11/2 min; both IQR 1 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

2. A median 19/2, B median 23/2 min; both IQR 1 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

3. A median 11/2, B median 15/2 min; both IQR 1 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

4. A median 9, B median 11 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

5. A median 8, B median 10 min; both IQR 4 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

6. A median 25/2, B median 29/2 min; both IQR 3 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

7. A median 17/2, B median 21/2 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

8. A median 11/2, B median 15/2 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

9. A median 13/2, B median 17/2 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

10. A median 9/2, B median 13/2 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

Writing a Complete Data Summary

Statistics and Data Displays

1. 6 observations of reading time in minutes. Mean 11/2 min, MAD 5/6 min; roughly symmetric, so mean/MAD are reasonable.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

2. 6 observations of reading time in minutes. Mean 19/2 min, MAD 5/6 min; roughly symmetric, so mean/MAD are reasonable.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

3. 6 observations of reading time in minutes. Mean 7/2 min, MAD 5/6 min; roughly symmetric, so mean/MAD are reasonable.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

4. 6 observations of reading time in minutes. Mean 13 min, MAD 5 min; roughly symmetric, so mean/MAD are reasonable.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

5. 6 observations of reading time in minutes. Mean 12 min, MAD 10/3 min; roughly symmetric, so mean/MAD are reasonable.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

6. 6 observations of reading time in minutes. Mean 17 min, MAD 5 min; roughly symmetric, so mean/MAD are reasonable.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

7. 6 observations of reading time in minutes. Median 15/2 min, IQR 2 min; right-skewed with a high value 18 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

8. 6 observations of reading time in minutes. Median 13/2 min, IQR 2 min; right-skewed with a high value 17 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

9. 6 observations of reading time in minutes. Median 17/2 min, IQR 2 min; right-skewed with a high value 19 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

10. 6 observations of reading time in minutes. Median 11/2 min, IQR 2 min; right-skewed with a high value 16 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

Unit 9 Test

Statistics and Data Displays

1. 35 m²
Reasoning Cut and shift a corner; A = bh = 5 × 7 = 35.

2. 28 cm³
Reasoning B = 2 × 7/2 = 7 cm²; V = B × 4 = 28 cm³.

3. 2 faces each of 2×3, 2×6, 3×6; 72 cm²
Reasoning Add 2(6) + 2(12) + 2(18) = 72.

4. 56 m²
Reasoning Outer area 80 minus cutout 24 = 56.

5. Yes; plant heights vary.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

6. Center near 7/2 min; range 3 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 5 - 2.

7. n = 6; minutes; mean 19/2 min
Reasoning Sum = 57; mean = 57 ÷ 6 = 19/2.

8. Median 14 min
Reasoning 6 ordered values: average positions 3 and 4: (12 + 16) ÷ 2 = 14.

9. Q1 11, Q3 14; IQR 3 min; range 9 min
Reasoning Lower half [8, 11, 11] has median 11; upper half [14, 14, 17] has median 14. Subtract Q1 from Q3.

10. Mean 12 min; MAD 10/3 min
Reasoning Distances: 6, 2, 2, 2, 2, 6; sum 20; divide by 6 = 10/3.

11. Mean 13 min and MAD 5 min; roughly symmetric data
Reasoning Mean = 13, median = 13, IQR = 16 - 10 = 6, MAD = 5. Accept another justified choice tied to shape and purpose.

12. 7: 1 dot; 13: 2 dots; 19: 2 dots; 25: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

13. Frequencies 3, 2, 3, 2
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

14. (6, 7, 15/2, 9, 18); IQR 2 min
Reasoning Box runs from 7 to 9, median line at 15/2, whiskers to 6 and 18.

15. A median 19/2, B median 23/2 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

16. 6 observations of reading time in minutes. Median 9/2 min, IQR 2 min; right-skewed with a high value 15 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

17. Example: On a 1 to 5 scale, how do students in our class rate the school library? Ratings vary among students; the numerical scale must be defined.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

18. Center near 9/2 min; range 12 min; right-skewed with high value 15 min
Reasoning The values cluster low with a long high tail. Range = 15 - 3.

19. n = 6; minutes; mean 31/6 min; new mean 37/7 min
Reasoning Sum = 31; mean = 31 ÷ 6 = 31/6. New sum = 37; divide by 7.

20. Median 7/2 min; mean 31/6 min; the high value pulls the mean upward
Reasoning 6 ordered values: average positions 3 and 4: (3 + 4) ÷ 2 = 7/2.

Designing a School Garden

Final Applications and Review

1. Sides 10 and 9; area 90 square units
Reasoning Horizontal length 10 - (0) = 10; vertical length 9 - (0) = 9; area = 10 × 9.

2. 12 cm²
Reasoning A = bh/2 = 12 × 2 ÷ 2 = 12. Two such triangles make a parallelogram.

3. 68 m²
Reasoning Outer area 108 minus cutout 40 = 68.

4. 64 m²
Reasoning A = (10 + 22) × 4 ÷ 2 = 64.

5. Sides 7 and 8; area 56 square units
Reasoning Horizontal length 5 - (-2) = 7; vertical length 5 - (-3) = 8; area = 7 × 8.

6. 21 cm²
Reasoning A = bh/2 = 6 × 7 ÷ 2 = 21. Two such triangles make a parallelogram.

7. 81 m²
Reasoning Whole rectangle 90; remove triangle 9; difference 81.

8. 26 m²
Reasoning A = (10 + 16) × 2 ÷ 2 = 26.

9. Sides 10 and 9; area 90 square units; perimeter 38 units
Reasoning Horizontal length 3 - (-7) = 10; vertical length 3 - (-6) = 9; area = 10 × 9.

10. 49/2 cm²
Reasoning A = bh/2 = 14 × 7/2 ÷ 2 = 49/2. Two such triangles make a parallelogram.

Planning Storage and Packaging

Final Applications and Review

1. 84 cm³
Reasoning B = 7 × 2 = 14 cm²; V = B × 6 = 84 cm³.

2. 140 cubes; each 1/8 cubic unit; prism 35/2 cubic units
Reasoning Counts along edges: 5, 7, 4. Product 140; 140 × 1/8 = 35/2, also lwh.

3. 2 faces each of 8×3, 8×5, 3×5; 158 cm²
Reasoning Add 2(24) + 2(40) + 2(15) = 158.

4. 170 cm²
Reasoning Closed surface area = 2(30+25+30) = 170.

5. 340 cm²
Reasoning Base = 100; each triangle = 10 × 12 ÷ 2 = 60; add four triangles to get 340.

6. 18 cm³
Reasoning B = 4 × 3/2 = 6 cm²; V = B × 3 = 18 cm³.

7. 36 cubes; each 1/27 cubic unit; prism 4/3 cubic units
Reasoning Counts along edges: 2, 3, 6. Product 36; 36 × 1/27 = 4/3, also lwh.

8. 2 triangles (area 6 each), rectangles 3×2, 4×2, 5×2; SA 36 cm²
Reasoning Triangle pair: 12 cm²; rectangles: (3+4+5) × 2 = 24; total 36.

9. 236 cm²
Reasoning Closed surface area = 2(56+48+42) = 292. Remove the top area 56: 236.

10. 156 cm²
Reasoning Base = 36; each triangle = 6 × 10 ÷ 2 = 30; add four triangles to get 156.

Reporting Class Reading Data

Final Applications and Review

1. Yes; pages read vary across students.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

2. n = 6; minutes; mean 15/2 min
Reasoning Sum = 45; mean = 45 ÷ 6 = 15/2.

3. Median 15/2 min
Reasoning 6 ordered values: average positions 3 and 4: (7 + 8) ÷ 2 = 15/2.

4. Q1 8, Q3 14; IQR 6 min; range 18 min
Reasoning Lower half [2, 8, 8] has median 8; upper half [14, 14, 20] has median 14. Subtract Q1 from Q3.

5. Mean 21/2 min; MAD 25/6 min
Reasoning Distances: 15/2, 5/2, 5/2, 5/2, 5/2, 15/2; sum 25; divide by 6 = 25/6.

6. 5: 1 dot; 10: 2 dots; 15: 2 dots; 20: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

7. Frequencies 3, 2, 4, 1; greatest: 10–14
Reasoning Count every value once. Bars touch and have equal width; horizontal axis is minutes, vertical axis is frequency.

8. (4, 5, 11/2, 7, 16); IQR 2 min
Reasoning Box runs from 5 to 7, median line at 11/2, whiskers to 4 and 16.

9. 6 observations of reading time in minutes. Median 19/2 min, IQR 2 min; right-skewed with a high value 20 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

10. Counterexample: How many sides does a triangle have? It has a fixed answer. A statistical question anticipates variability in a collection of data.
Reasoning Look for a collection of data and anticipated variation; identify the population and variable.

Connecting Models and Explanations

Final Applications and Review

1. 40 cm²
Reasoning A = bh/2 = 16 × 5 ÷ 2 = 40. Two such triangles make a parallelogram.

2. 25 cm³
Reasoning B = 5 × 5/2 = 25/2 cm²; V = B × 2 = 25 cm³.

3. 130 cm²
Reasoning Closed surface area = 2(20+25+20) = 130.

4. Center near 21/2 min; range 9 min; roughly symmetric; no isolated extreme
Reasoning The values balance around the middle. Range = 15 - 6.

5. n = 6; minutes; mean 21/2 min
Reasoning Sum = 63; mean = 63 ÷ 6 = 21/2.

6. Q1 13, Q3 18; IQR 5 min; range 15 min
Reasoning Lower half [8, 13, 13] has median 13; upper half [18, 18, 23] has median 18. Subtract Q1 from Q3.

7. Mean 55/6 min; MAD 53/18 min; a typical distance from the mean is 53/18 min
Reasoning Distances: 19/6, 13/6, 13/6, 7/6, 1/6, 53/6; sum 53/3; divide by 6 = 53/18.

8. (2, 3, 7/2, 5, 14); IQR 2 min
Reasoning Box runs from 3 to 5, median line at 7/2, whiskers to 2 and 14.

9. A median 15/2, B median 19/2 min; both IQR 2 min. B is typically 2 min higher; equal middle-half variability.
Reasoning Adding 2 shifts all values and the median by 2, but does not change Q3 - Q1.

10. 6 observations of reading time in minutes. Median 7/2 min, IQR 2 min; right-skewed with a high value 14 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.

Final Review Quiz

Final Applications and Review

1. 7: 1 dot; 8: 2 dots; 9: 2 dots; 10: 1 dot; n = 6
Reasoning Each observation contributes one dot; stack repeated values at their number-line position.

2. 48 m²
Reasoning A = (10 + 14) × 4 ÷ 2 = 48.

3. 12 cm³
Reasoning B = 1 × 3 = 3 cm²; V = B × 4 = 12 cm³.

4. (4, 5, 11/2, 7, 16); IQR 2 min
Reasoning Box runs from 5 to 7, median line at 11/2, whiskers to 4 and 16.

5. 6 observations of reading time in minutes. Median 13/2 min, IQR 2 min; right-skewed with a high value 17 min, so median/IQR resist that value.
Reasoning Calculate the center and spread before interpreting them in context. Other accurate, justified summaries are acceptable.