

PRACTICE EXAM 4: STATIONARY ENGINEER APPRENTICE SIMULATION (100 QUESTIONS)

This practice exam contains 100 questions covering Math and Algebra, Mechanical Reasoning, Reading Comprehension, and Spatial Reasoning, mirroring the aptitude-test format commonly used by IUOE local Joint Apprenticeship and Training Committees for stationary engineer apprenticeship entrance screening. Time limit and passing score vary by administering local; work at a steady pace and answer every question, since most locals rank candidates competitively by score rather than applying a single fixed cutoff.

1. Add the fractions: $\frac{2}{3} + \frac{1}{5} = ?$

- A. $\frac{3}{8}$
- B. $\frac{13}{15}$
- C. $\frac{11}{15}$
- D. $\frac{3}{5}$

2. Calculate: $0.45 \times 60 = ?$

- A. 2.7
- B. 270
- C. 24
- D. 27

3. Evaluate: $20 - 2 \times (9 - 5) = ?$

- A. 12
- B. 72
- C. 16
- D. -8

4. What is 35% of 180?

- A. 54
- B. 72
- C. 63
- D. 35

5. A reading rises from 75 to 90. What is the percent increase?

- A. 17%
- B. 25%
- C. 15%
- D. 20%

6. A drawing uses a scale of 1 inch = 15 feet. A room measures 4 inches on the drawing. What is its actual length?

- A. 56 feet
- B. 19 feet
- C. 60 feet
- D. 64 feet

7. Fittings cost \$3.50 each. What is the total cost of 18 fittings?

- A. \$63.00
- B. \$60.00
- C. \$66.50
- D. \$59.50

8. Solve for x : $6x - 9 = 27$

- A. $x = 3$
- B. $x = 6$
- C. $x = 4.5$
- D. $x = 4$

9. Simplify: $5(2x - 4) + 3x$

- A. $13x - 20$
- B. $10x - 4$
- C. $13x - 4$
- D. $8x - 20$

10. Simplify: $5^2 \times 5^3$

- A. 15625
- B. 3125
- C. 625
- D. 25

11. Simplify the square root: $\sqrt{48}$

- A. $12\sqrt{3}$
- B. $16\sqrt{3}$
- C. $4\sqrt{12}$
- D. $4\sqrt{3}$

12. Find the next term: 7, 13, 19, 25, ____

- A. 28
- B. 33
- C. 31
- D. 29

13. Find the next term in this geometric sequence: 3, 9, 27, 81, ____

- A. 162
- B. 243
- C. 324
- D. 180

14. A line passes through the points (2, 4) and (7, 19). What is its slope?

- A. 15
- B. $\frac{1}{3}$
- C. 5
- D. 3

15. 27 is what percent of 90?

- A. 33.3%
- B. 27%
- C. 30%
- D. 24%

16. Two technicians can each complete a maintenance route alone in 3 hours and 6 hours respectively. Working together at their combined rate, how long will the route take?

- A. 2 hours
- B. 4.5 hours

- C. 3 hours
- D. 1.5 hours

17. Convert 8.5 feet to inches.

- A. 96 inches
- B. 104 inches
- C. 85 inches
- D. 102 inches

18. Evaluate: $14 - (6 - 10)$

- A. 18
- B. -2
- C. 10
- D. -10

19. A value of 96 is 20% more than the original amount. What was the original amount?

- A. 76.8
- B. 80
- C. 115.2
- D. 84

20. Simplify the ratio 20:30 to lowest terms.

- A. 4:6
- B. 3:5
- C. 2:3
- D. 1:2

21. Evaluate: $3^0 + 4^{(-1)}$

- A. $1 \frac{1}{4}$
- B. 0
- C. 3.25
- D. 1

22. Multiply the mixed numbers: $1 \frac{1}{2} \times 2 \frac{2}{3}$

- A. 4.5
- B. 4
- C. 3.5
- D. 3

23. A 42-foot cable is cut into sections that are each 2.8 feet long. How many full sections result?

- A. 16
- B. 14
- C. 12
- D. 15

24. Solve for x: $9x - 4 = 5x + 24$

- A. $x = 4$
- B. $x = 14$
- C. $x = 7$
- D. $x = 5$

25. A payroll table shows 3 hours worked pays \$52.50, and 6 hours worked pays \$105. What is the hourly rate?

- A. \$17.50
- B. \$35.00
- C. \$17.00
- D. \$105.00

26. A pair of tweezers, where the effort sits between the fulcrum and the load, is an example of which class of lever?

- A. First-class lever
- B. Second-class lever
- C. Not a lever at all
- D. Third-class lever

27. A single fixed pulley mounted overhead changes which property of an applied force?

- A. Its magnitude only, not its direction
- B. Both its direction and its magnitude
- C. Its direction only, not its magnitude
- D. Neither; a fixed pulley has no effect at all

28. A driving gear with 10 teeth meshes with a driven gear with 40 teeth. How does the driven gear's speed compare to the driving gear's speed?

- A. It turns 4 times as fast
- B. It turns at $\frac{1}{4}$ the speed
- C. It turns at the same speed
- D. It turns at $\frac{1}{10}$ the speed

29. A pry bar's fulcrum is positioned so the effort arm is 32 inches and the load arm is 4 inches. What is its mechanical advantage?

- A. 28
- B. 0.125
- C. 8
- D. 128

30. Which of Newton's laws states that an object at rest stays at rest, and an object in motion stays in motion, unless acted on by an outside force?

- A. The first law
- B. The second law, describing $F=ma$
- C. The third law, describing action and reaction
- D. None of Newton's laws; this is a separate principle

31. Which type of friction opposes motion that is already occurring, rather than the initial start of motion from rest?

- A. Static friction
- B. Rolling resistance exclusively
- C. No friction at all
- D. Kinetic friction

32. A block-and-tackle system uses 6 rope segments to support a 420-pound load. Ignoring friction, what effort force is required?

- A. 420 pounds
- B. 70 pounds
- C. 2520 pounds
- D. 210 pounds

33. A wedge splits material apart by converting a forward driving force into which type of force?

- A. A purely rotational force
- B. A purely vertical lifting force
- C. A sideways spreading force
- D. No conversion occurs at all

34. A hydraulic system has an input piston with an area of 2.5 square inches and an output piston with an area of 20 square inches. What is its mechanical advantage?

- A. 8
- B. 17.5
- C. 2.5
- D. 50

35. A circuit has a 18-volt source and a total resistance of 6 ohms. Using Ohm's law, what is the current?

- A. 108 amps
- B. 3 amps
- C. 0.33 amps
- D. 12 amps

36. In a parallel circuit, the voltage measured across each individual branch will be:

- A. Different for each individual branch
- B. Zero unless a series component is also present
- C. Impossible to determine without knowing the current
- D. The same across every branch

37. Adding more components in series to a circuit always ____ the circuit's total resistance.

- A. decreases
- B. does not change
- C. increases
- D. cuts in half

38. Touching a hot pipe directly and feeling the heat immediately demonstrates which mode of heat transfer?

- A. Convection
- B. Conduction
- C. Radiation
- D. Insulation

39. As fluid moves from a narrow section of pipe into a wider section, its velocity ____, according to the continuity principle.

- A. decreases
- B. increases
- C. stays the same
- D. reverses direction

40. Which valve type is designed for a fully open or fully closed position, with minimal flow restriction when open?

- A. Globe valve
- B. Check valve
- C. Needle valve
- D. Gate valve

41. A coarse-pitch screw advances farther per turn than a fine-pitch screw, but provides ____ mechanical advantage.

- A. greater
- B. the same
- C. less
- D. no measurable

42. An inclined plane reduces the force needed to raise a load, at the cost of moving the load a greater:

- A. Distance
- B. Amount of friction
- C. Total weight
- D. Mechanical disadvantage

43. A compound machine combines a lever with a mechanical advantage of 4 and a screw with a mechanical advantage of 18. What is the overall mechanical advantage?

- A. 22
- B. 4
- C. 18
- D. 72

44. Inserting an idler gear into a two-gear train reverses rotation direction back to the original. What happens to the overall gear ratio between the first and last gear?

- A. It doubles
- B. It stays exactly the same, unaffected by the idler
- C. It is cut in half
- D. It reverses along with the direction

45. A gauge reads 55 psi. What is the approximate absolute pressure?

- A. 55 psi

- B. 69.7 psi
- C. 40.3 psi
- D. 84.4 psi

46. A driving pulley with a 6-inch diameter turns at 600 RPM and drives a belt connected to a 8-inch driven pulley. What is the driven pulley's speed?

- A. 450 RPM
- B. 800 RPM
- C. 600 RPM
- D. 300 RPM

47. A wheelbarrow, where the load sits between the fulcrum and the applied effort, is a classic example of which lever class?

- A. First-class lever
- B. Third-class lever
- C. Second-class lever
- D. A pulley, not a lever at all

48. For the same pair of surfaces, which generally requires more force to overcome: static friction or kinetic friction?

- A. Kinetic friction
- B. They always require exactly equal force
- C. Neither; type has no effect
- D. Static friction

49. An impact wrench generates very high peak torque from a comparatively small motor primarily through which mechanism?

- A. Continuous smooth rotation alone
- B. Hydraulic fluid pressure
- C. Rapid rotational hammering impacts
- D. A large fixed gear reduction alone

50. An object's mass stays the same everywhere, while its weight changes because weight depends on:

- A. The local force of gravity
- B. The object's mass changing between locations
- C. The object's material composition changing
- D. Nothing; weight never actually changes anywhere

51. Passage: "A economizer preheats incoming feedwater using residual heat from exhaust gases, improving overall boiler efficiency." What is the main idea?

- A. Economizers actually reduce a boiler's overall efficiency
- B. An economizer improves boiler efficiency by preheating feedwater with residual exhaust heat
- C. Feedwater temperature has no real connection to boiler efficiency
- D. Exhaust gases carry no usable residual heat at all

52. Passage: "Before restarting a cooling tower fan after service, first confirm the belt guard is reinstalled. Then verify the fan blades rotate freely by hand. Only after both checks should power be restored." If the belt guard is missing, what should happen?

- A. Restore power anyway, since the blades can be checked later
- B. Skip directly to restoring power regardless of the guard
- C. Reinstall the guard only after power has already been restored
- D. Power should not be restored until the belt guard is reinstalled

53. Passage: "The technician described the reading as anomalous, sharply different from every previous inspection on record." In this context, "anomalous" most likely means:

- A. perfectly normal and entirely expected
- B. unusual or deviating from what is normally expected
- C. extremely precise and highly reliable
- D. recorded incorrectly due to equipment failure

54. Passage: "After the bearing was repacked with fresh grease, the motor's operating temperature dropped back into its normal range." What can be validly inferred?

- A. The motor itself was replaced during this repair
- B. Operating temperature has no real connection to bearing lubrication
- C. The old, depleted grease had likely been contributing to the elevated temperature
- D. The bearing will never require repacking again in the future

55. Passage: "A low-suction alarm activates when intake pressure drops below its set point, warning operators before the pump runs dry." Which statement accurately reflects this passage?

- A. The alarm activates causes intake pressure to drop
- B. Running dry is what actually triggers this particular alarm
- C. The alarm only ever activates after the pump has already run dry
- D. The alarm activates to warn operators before the pump can run dry

56. Passage: "Ultrasonic testing detects internal pipe wall thinning long before a leak would otherwise become visible. Acting on this data during scheduled inspection avoids unplanned failures." What is the main idea?

- A. Ultrasonic testing enables proactive maintenance that avoids unplanned pipe failures
- B. Ultrasonic testing is rarely useful in real maintenance work
- C. Pipe walls do not actually thin under normal use
- D. Unplanned failures have no real connection to inspection data

57. Passage: "To isolate a pump for repair, first close the suction valve. Next, close the discharge valve. Then vent trapped pressure. Finally, verify zero pressure before opening the casing." What is the correct second step in this sequence?

- A. Close the suction valve
- B. Vent trapped pressure
- C. Verify zero pressure before opening the casing
- D. Close the discharge valve

58. Passage: "The inspection log noted the fitting had begun to weep, showing a slow, barely visible seepage rather than an active leak." In this context, "weep" most likely means:

- A. spray forcefully in a visible stream
- B. remain completely dry with no moisture at all
- C. seep slowly and barely visibly
- D. change color without any moisture present

59. Passage: "Before opening a chemical feed line, first confirm the correct PPE is worn. Next, verify the line is depressurized. Finally, open the line slowly while facing away from the connection." What must happen before the line is opened?

- A. Facing directly toward the connection point
- B. Confirming the correct PPE is worn and verifying the line is depressurized
- C. Opening the line as quickly as possible
- D. No steps are required before opening the line

60. Passage: "To adjust a thermostat's calibration, first record the current setpoint. Next, compare it to a certified reference thermometer. If the readings match within one degree, no adjustment is needed." The readings match within one degree. What should the technician do?

- A. No adjustment is needed
- B. Adjust the thermostat anyway, just to be certain

- C. Repeat the comparison a second time regardless
- D. Replace the thermostat immediately regardless of the reading

61. Passage: "The technician described the connection as secure, showing no measurable movement when tested by hand." In this context, "secure" most likely means:

- A. firmly fastened with no detectable movement
- B. loose and prone to significant movement
- C. impossible to test by hand at all
- D. recently disconnected and awaiting reconnection

62. Passage: "Since the new drive belt was installed, no further slippage has been detected during weekly inspections." What can be validly inferred?

- A. The motor itself was replaced during this repair
- B. Slippage has no real connection to the drive belt
- C. The new belt will never require replacement in the future
- D. The old drive belt had likely been the source of the slippage

63. Passage: "The specification calls for a fastener torque of 60 to 70 ft-lbs." Which of the following values falls within the specified range?

- A. 55 ft-lbs
- B. 65 ft-lbs
- C. 72 ft-lbs
- D. 78 ft-lbs

64. Passage: "Eyewash stations provide immediate flushing for chemical exposure to the eyes. Weekly activation testing ensures the flow mechanism still functions when needed." What is the main idea?

- A. Eyewash stations require no testing once installed

- B. Chemical exposure incidents are extremely rare and unlikely
- C. Weekly testing ensures eyewash stations remain functional for chemical exposure incidents
- D. Testing has no real connection to how well the flow performs

65. Passage: "Confirm the tag is verified, then check that the equipment cannot be energized remotely, and only then begin work." If remote energizing cannot yet be ruled out, what should happen?

- A. Begin work anyway, since the tag is verified
- B. Skip the remote-energizing check entirely this time
- C. Verify the tag a second time before proceeding
- D. Work should not begin until remote energizing has been ruled out

66. Passage: "The readings were described as sporadic, appearing at irregular intervals with no consistent pattern." In this context, "sporadic" most likely means:

- A. occurring at perfectly regular, predictable intervals
- B. occurring irregularly with no consistent pattern
- C. occurring continuously without any interruption
- D. never occurring at all under any circumstances

67. Passage: "After the alignment coupling was replaced, the unusual whining sound during operation no longer occurred." What can be validly inferred?

- A. The failing coupling had likely been causing the whining sound
- B. The motor itself was rewound during this repair
- C. The whining sound was actually unrelated to the coupling
- D. The whining sound will return regardless of any repair made

68. Passage: "A clogged air filter increases resistance to airflow and can cause a blower motor to run hotter than normal." Which statement correctly reflects this passage?

- A. Motor heat is what actually causes the filter to clog
- B. A clean filter is what increases airflow resistance instead
- C. A clogged filter causes increased resistance, which can lead to a hotter motor
- D. Filter condition has no measurable effect on motor temperature

69. Passage: "Confined space entry permits require atmospheric testing and a documented rescue plan. This protects workers from toxic exposure and ensures a rapid emergency response." What is the main idea?

- A. Confined space entry permits require no special precautions
- B. Atmospheric testing becomes optional once a rescue plan exists
- C. A rescue plan only helps with toxic exposure, not response time
- D. Atmospheric testing and a rescue plan protect workers and ensure rapid emergency response

70. Passage: "The work order specifies equipment tag number and required completion date." Based only on this passage, which of the following is NOT stated as required?

- A. The assigned technician's certification number
- B. The equipment tag number
- C. The required completion date
- D. That the work order specifies certain requirements at all

71. Passage: "Once the condensate trap was cleared, the steam system's pressure fluctuations stopped entirely." What can be validly inferred?

- A. The boiler itself was replaced during this repair
- B. Pressure fluctuations have no real connection to the trap
- C. The blocked condensate trap had likely been causing the pressure fluctuations
- D. The trap will never require clearing again in the future

72. Passage: "Isolate the breaker, test for zero voltage with a meter, then apply personal locks before beginning work." What is the correct final step before work begins?

- A. Isolating the breaker
- B. Applying personal locks
- C. Testing for zero voltage with a meter
- D. No step is required before work begins

73. Passage: "The compressor exhibited short-cycling, rapidly starting and stopping in quick succession rather than running a normal full cycle." In this context, "short-cycling" refers to:

- A. a complete and permanent shutdown of the compressor
- B. a type of scheduled preventive maintenance procedure
- C. an electrical short circuit within the compressor motor
- D. rapidly starting and stopping rather than completing a normal cycle

74. Passage: "The manual specifies a belt deflection of $\frac{3}{8}$ to $\frac{1}{2}$ inch under moderate thumb pressure." Which of the following values falls within the specified range?

- A. $\frac{7}{16}$ inch
- B. $\frac{1}{4}$ inch
- C. $\frac{9}{16}$ inch
- D. $\frac{5}{8}$ inch

75. Passage: "Bonding jumpers maintain electrical continuity across a pipe union, preventing a spark hazard where the pipe is otherwise interrupted." What is the main idea?

- A. Bonding jumpers actually increase spark hazard risk at unions
- B. Bonding jumpers prevent spark hazards by maintaining continuity across pipe unions
- C. Electrical continuity has no real connection to spark hazards
- D. Bonding jumpers only matter where pipes are not interrupted

76. A flat shape has a small notch cut into its top-right corner. If the shape is rotated 90 degrees clockwise, where will the notch now appear?

- A. In the top-left corner
- B. In the bottom-left corner
- C. In the bottom-right corner
- D. It remains in the top-right corner

77. A flat shape has a small shaded mark in its bottom-right corner. If the shape is rotated 180 degrees, where will the shaded mark now appear?

- A. In the top-left corner
- B. In the bottom-left corner
- C. In the top-right corner
- D. It remains in the bottom-right corner

78. A flat shape has a small tab attached to its left edge. If the shape is reflected (mirrored) across a horizontal axis, flipping it top-to-bottom, which edge will the tab now be attached to?

- A. The right edge
- B. The left edge, unchanged in left-right position
- C. The top edge
- D. The bottom edge

79. A cross-shaped cube net has a central square P, with squares Q (above P), R (below P), S (left of P), and T (right of P), plus a sixth square U attached below R, so that Q, P, R, and U form one continuous column of four. Once folded into a cube, which face is opposite face P?

- A. Face Q
- B. Face R
- C. Face U
- D. Face S

80. In the same net described above (Q above P, R below P, S left of P, T right of P, U below R), which two squares become opposite each other as the cube's remaining pair of faces?

- A. Q and R
- B. P and U
- C. Q and U
- D. S and T

81. An object's front view shows a circular hole, but its top view and side view are both plain rectangles with no opening shown. What does this indicate about the hole?

- A. The hole passes completely through the object from top to bottom
- B. The hole passes completely through the object from side to side
- C. There is actually no hole present in the object at all
- D. The hole does not extend through the object in any other direction; it is visible only from the front

82. An object's front view is a plain rectangle, but its top view and side view both show a rectangular notch cut from the same corner. What does this indicate about the object?

- A. A hole passes completely through the object
- B. A corner has been cut from the top, visible in both views
- C. The object is a perfect, unmodified rectangular block
- D. The notch appears only in the top view, not the side view

83. A flat shape has a small notch cut into its bottom-left corner. If the shape is rotated 270 degrees clockwise, where will the notch now appear?

- A. In the bottom-right corner
- B. In the top-left corner
- C. In the top-right corner
- D. It remains in the bottom-left corner

84. A flat shape has a small tab attached to its top edge. If the shape is reflected (mirrored) across a vertical axis, which edge will the tab now be attached to?

- A. The bottom edge
- B. The left edge
- C. The top edge, unchanged in top-bottom position
- D. The right edge

85. A net for a rectangular box (cuboid) shows six connected rectangles of varying sizes. How many pairs of opposite, identically-sized faces will the folded box have?

- A. 2
- B. 4
- C. 6
- D. 3

86. A blueprint uses a scale of 1:30. A wall measures 5 centimeters on the drawing. What is the wall's actual length?

- A. 30 centimeters
- B. 150 centimeters
- C. 35 centimeters
- D. 500 centimeters

87. On a technical drawing, a long-short-long dash pattern typically represents:

- A. A hidden edge blocked from direct view
- B. A visible edge seen directly in this view
- C. A center line marking the axis of a round or symmetrical feature
- D. A dimension line showing a measured distance

88. A flat shape has a small notch cut into its top-left corner. If the shape is rotated 90 degrees counterclockwise, where will the notch now appear?

- A. In the bottom-left corner
- B. In the top-right corner
- C. In the bottom-right corner
- D. It remains in the top-left corner

89. An object's front view shows two circles stacked vertically, and its side view shows a matching rectangle with two circles in the same vertical spacing. What does this indicate about the object?

- A. The holes are drilled from top to bottom only, not front to back
- B. Only one hole actually exists in the object
- C. Two holes are drilled through the object from front to back, stacked vertically
- D. The two holes are located on completely different sides of the object

90. A flat shape has a small shaded mark on its bottom edge. If the shape is rotated 90 degrees clockwise, which edge will the shaded mark now be on?

- A. The left edge
- B. The right edge
- C. The top edge
- D. The bottom edge, unchanged

91. A proposed cube net contains six squares, but two of them are attached at positions that would cause them to occupy the exact same face once folded. This net is best described as:

- A. Valid, since all cube nets allow minor overlap between faces
- B. Invalid, since a valid cube net cannot produce overlapping faces
- C. Valid, but only when folded in a specific reverse order
- D. Invalid only if it also has fewer than six squares

92. A shape's mirror image (reflection) differs from any rotation of the same shape because a reflection:

- A. Always makes the shape appear larger
- B. Only changes the shape's outline thickness
- C. Produces an identical result to a 90-degree rotation
- D. Reverses the shape's handedness, which no rotation can ever reproduce

93. A flat shape has a small shaded mark on its right edge. If the shape is rotated 180 degrees, which edge will the shaded mark now be on?

- A. The top edge
- B. The bottom edge
- C. The right edge, unchanged
- D. The left edge

94. A proposed cube net contains only three connected squares rather than the usual six. This net is best described as:

- A. Invalid, since a valid cube net must contain exactly six squares
- B. Valid, since three squares can still fold into a closed shape
- C. Valid, but only when folded in a specific reverse order
- D. Invalid only because two of the three squares would overlap

95. A flat shape has a small shaded mark on its left edge. If the shape is rotated 90 degrees clockwise, which edge will the shaded mark now be on?

- A. The right edge
- B. The bottom edge
- C. The top edge
- D. The left edge, unchanged

96. In a standard orthographic drawing layout, the top view is positioned directly ____ the front view.

- A. below
- B. above
- C. to the right of
- D. diagonally opposite

97. Two different views of the same blueprint show two different dimensions for what should be the identical feature. The best response is to:

- A. Automatically assume the smaller dimension is correct
- B. Flag the discrepancy and verify it against the source drawing before use
- C. Treat the difference as normal and take no action
- D. Average the two dimensions together and use that value

98. A flat shape has a small shaded mark in its top-left corner. If the shape is rotated 180 degrees, where will the shaded mark now appear?

- A. In the top-right corner
- B. In the bottom-left corner
- C. In the bottom-right corner
- D. It remains in the top-left corner

99. A cube net has a horizontal row of four squares, with one additional square attached above the third square in the row, and another additional square attached below the second square in the row. Is this a valid cube net, and how many total squares does it contain?

- A. Yes, it is valid, and it contains six total squares
- B. No, it is invalid because only five squares are actually present
- C. Yes, it is valid, but it contains only five total squares
- D. No, it is invalid because two of the squares overlap

100. A candidate is running low on time and still has several spatial rotation items remaining on the exam. According to the strategy covered in this chapter, the candidate should:

- A. Immediately switch to guessing every remaining item at random
- B. Skip all remaining spatial items entirely without attempting any
- C. Slow down significantly to double-check every single completed item
- D. Continue applying the single-feature tracking method rather than switching to random guessing immediately

Practice Exam 4: Answer Key and Explanations

1. B — Convert to a common denominator of 15: $\frac{2}{3}$ becomes $\frac{10}{15}$, and $\frac{1}{5}$ becomes $\frac{3}{15}$. Adding the numerators gives $\frac{13}{15}$. Adding numerators and denominators straight across produces $\frac{3}{8}$, an entirely different value that ignores the need for a shared denominator before combining any two fractions. This same common-denominator method works for adding any two unlike fractions correctly.

2. D — Multiplying 0.45 by 60 gives 27. Misplacing the decimal point in either direction produces 2.7 or 270, since the total number of decimal places across both factors must be counted carefully before the decimal point is placed in the final product, not estimated loosely. Counting total decimal places across both original factors avoids this specific shortfall.

3. A — Parentheses first: $9 - 5 = 4$. Then multiplication: $2 \times 4 = 8$. Finally subtraction: $20 - 8 = 12$. Subtracting before multiplying ($20 - 2 = 18$, then roughly $18 \times 4 = 72$) applies the operations in the wrong order, producing the incorrect distractor shown here. Rewriting the expression after each individual step avoids this specific sequencing trap.

4. C — Convert 35% to a decimal (0.35) and multiply: $0.35 \times 180 = 63$. A distractor of 35 simply restates the percentage value itself rather than calculating the actual portion of 180, confusing the stated percentage with the final calculated answer entirely. This same decimal-multiplication approach applies to finding any percentage of a number.

5. D — Percent change = $(\text{new} - \text{original}) / \text{original} \times 100 = (90 - 75) / 75 \times 100 = 20\%$. Using the new value (90) as the denominator instead of the original (75) produces the incorrect 17% distractor, a common and entirely avoidable setup error covered earlier in this book. Always use the original starting value as the denominator, never the new value.

6. C — Multiply the drawing measurement by the scale factor: $4 \times 15 = 60$ feet. Adding instead of multiplying ($4 + 15 = 19$) confuses the scale relationship with simple addition, ignoring that a scale factor is a multiplying ratio applied to the drawing measurement, not an offset. Confirming which unit the scale factor multiplies before applying it prevents this error.

7. A — Multiply unit price by quantity: $3.50 \times 18 = \$63.00$. Rounding $\$3.50$ down to $\$3.00$ before multiplying ($3.00 \times 18 = \$54.00$, close to a lower rounded distractor) drops part of the true unit price, understating the actual total cost by ignoring the extra 50 cents on each fitting. Confirming both factors' full decimal places before multiplying prevents an understated total.

8. B — Add 9 to both sides: $6x = 36$. Divide both sides by 6: $x = 6$. Dividing 27 by 6 first without adding 9 back produces an incorrect rounded distractor; undoing subtraction before undoing multiplication is the correct order for solving this type of equation. Undoing addition before undoing multiplication is the standard, correct balance-method order here.

9. A — Distribute first: $5(2x-4) = 10x - 20$. Then combine like terms: $10x + 3x = 13x$, giving $13x - 20$. Forgetting to distribute the 5 across the -4 term, leaving it as -4 rather than -20 , produces the $13x - 4$ distractor shown here. Distributing every term inside the parentheses, including the constant, prevents this specific mistake.

10. B — Using the same-base exponent rule, add the exponents: $5^2 \times 5^3 = 5^5 = 3125$. Multiplying the base by the sum of the exponents ($5 \times 5 = 25$) confuses this exponent rule with simple multiplication, a common mechanical error under time pressure on this exam. Adding exponents only works correctly when the two base numbers actually match exactly.

11. D — 48 factors as 16×3 , and 16 is a perfect square, so $\sqrt{48} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$. Leaving the perfect-square factor un-square-rooted, treating 48 as 4 times 12 rather than 16 times 3, produces the unsimplified $4\sqrt{12}$ distractor shown here. Factoring out the largest available perfect square first gives the fully simplified radical.

12. C — This is an arithmetic sequence with a common difference of 6 ($13-7=6$, $19-13=6$, $25-19=6$). The next term is $25 + 6 = 31$. Using an incorrect difference of 3 instead of 6 produces the 28 distractor, a common miscount when scanning the sequence too quickly. Confirming the common difference by subtracting consecutive terms first prevents a miscounted pattern.

13. B — Each term is multiplied by a common ratio of 3 ($9/3=3$, $27/9=3$, $81/27=3$). The next term is $81 \times 3 = 243$. Adding the most recent difference between terms instead ($81+81=162$) mistakenly treats this geometric sequence as if it were arithmetic instead. Confirming the common ratio by dividing consecutive terms first prevents this sequencing error.

14. D — Slope equals the change in y divided by the change in x : $(19-4)/(7-2) = 15/5 = 3$. Reporting only the change in y without dividing by the change in x produces the distractor of 15, dropping the required second half of the slope calculation entirely. Always divide by the full run, not just report the rise alone.

15. C — Divide the part by the whole and convert to a percent: $27 / 90 = 0.30 = 30\%$. Dividing 90 by 27 instead, or rounding the division imprecisely, produces the incorrect distractors shown here; always confirm which value is the part before starting the division. Confirming which value represents the part and which represents the whole comes first.

16. A — Combined rate = $\frac{1}{3} + \frac{1}{6} = \frac{3}{6}$ of the route per hour, so time = $1 / (\frac{3}{6}) = 2$ hours. Averaging the two individual times directly, $(3+6)/2 = 4.5$ hours, ignores that combined work rates add together rather than simply averaging the two separate completion times. Converting each rate to a per-hour fraction prevents this error.

17. D — Multiply by the conversion factor 12 inches per foot: $8.5 \times 12 = 102$ inches. Rounding 8.5 down to 8 before multiplying ($8 \times 12 = 96$) drops the half-foot, producing an answer that is 6 inches short of the actual correct total length. Multiplying by the full decimal value of the given measurement avoids this shortfall.

18. A — Parentheses first: $6 - 10 = -4$. Then $14 - (-4) = 14 + 4 = 18$. Treating the subtraction sign as applying only to the 6 and not the full parenthetical result ($14-6-10=-2$) is a common order-of-operations trap covered earlier in this book. Rewriting the parentheses as one signed value before combining terms prevents this trap.

19. B — If 96 is 20% more than the original, then $96 = \text{original} \times 1.20$, so $\text{original} = 96 / 1.20 = 80$. Multiplying 96 by 0.80 instead of dividing by 1.20 produces the incorrect 76.8 distractor, confusing a percent increase calculation with a percent decrease instead. Dividing by the full multiplier, not a partial percentage figure, gives the correct value.

20. C — Both numbers share a greatest common factor of 10: $20/10 = 2$ and $30/10 = 3$, giving 2:3. The distractor 4:6 divides by only 5 instead of the full greatest common factor of 10, leaving the ratio only partially, not fully, reduced to its simplest possible form. Dividing by the true greatest common factor gives the fully reduced ratio.

21. A — Any nonzero base to the zero power equals 1, and a negative exponent indicates a reciprocal: $4^{(-1)} = 1/4$. Adding these gives $1 + 1/4 = 1 \frac{1}{4}$. Treating $4^{(-1)}$ as -4 instead of $1/4$ produces an incorrect distractor, confusing a negative exponent with a negative result. Applying the zero-exponent and negative-exponent rules separately, then adding, avoids this mix-up.

22. B — Convert both to improper fractions first: $1 \frac{1}{2} = \frac{3}{2}$ and $2 \frac{2}{3} = \frac{8}{3}$. Multiply: $(3 \times 8) / (2 \times 3) = 24/6 = 4$. Multiplying only the whole-number parts and fraction parts separately, rather than converting to improper fractions first, produces the incorrect distractor of 3.5. Converting every mixed number to an improper fraction before multiplying prevents this shortfall.

23. D — Divide the total length by the section length: $42 / 2.8 = 15$ sections, with no length left over. Rounding 2.8 up to 3 feet per section before dividing ($42/3=14$) produces an incorrect count based on the wrong, rounded section length instead. Dividing by the exact stated section length, not a rounded value, gives the correct count.

24. C — Subtract $5x$ from both sides: $4x - 4 = 24$. Add 4 to both sides: $4x = 28$. Divide by 4: $x = 7$. Subtracting $9x$ from both sides instead of the smaller term ($5x$) leads to extra sign-flipping and is a common source of the $x = 4$ distractor.

25. A — Divide pay by hours using either data point: $52.50/3 = \$17.50$ per hour (confirmed by $105/6 = \$17.50$). Dividing 52.50 by 1.5 instead of 3, or otherwise misreading the table's rows, produces the

incorrect \$35.00 distractor shown here. Confirming the correct row and column before dividing pay by hours avoids this misread entirely.

26. D — In a third-class lever, the effort sits between the fulcrum and the load, exactly as in a pair of tweezers or a fishing rod. A first-class lever instead places the fulcrum between effort and load, as in a pry bar, a different arrangement entirely. Locating the effort's exact position relative to the fulcrum and load classifies any lever quickly.

27. C — A single fixed pulley redirects the pull of a rope without multiplying the force applied to it; the full weight of the load must still be lifted, just from a more convenient direction. Claiming it changes the force magnitude overstates what a single fixed pulley actually does. Recognizing this distinction between fixed and movable pulleys is essential here.

28. B — Gear ratio is inversely proportional to speed: with 4 times as many teeth (40 vs 10), the driven gear turns at $1/4$ the speed of the driving gear while delivering more torque. Assuming more teeth means faster rotation reverses this actual inverse relationship entirely. This inverse tooth-count relationship holds true for any pair of meshed gears encountered.

29. C — Mechanical advantage for a lever equals the effort arm length divided by the load arm length: $32/4 = 8$. Dividing the load arm by the effort arm instead ($4/32 = 0.125$) inverts the correct ratio and produces the incorrect distractor shown here. Placing the effort arm length in the numerator, not the load arm, avoids this reversal.

30. A — Newton's first law describes inertia, an object's tendency to resist any change in its current state of motion. The second law instead relates force, mass, and acceleration, and the third law describes equal and opposite reactions, both entirely different relationships from this inertia scenario. Recognizing each law's distinct relationship prevents confusing one Newtonian principle for another entirely.

31. D — Kinetic friction specifically opposes motion already in progress, while static friction only opposes the initial start of motion from rest. Friction does not disappear once an object begins moving; it simply transitions to this generally smaller but still very real kinetic form instead. Confirming which phase of motion a question describes determines the correct friction type here.

32. B — Mechanical advantage equals the number of supporting rope segments: 6. $\text{Effort} = \text{load} / \text{mechanical advantage} = 420/6 = 70$ pounds. Failing to divide by the number of supporting segments, and simply restating the full load weight, produces the 420-pound distractor shown here. Dividing load by the correct segment count, not guessing, gives the accurate effort force.

33. C — A wedge, such as an axe head or chisel, is essentially two inclined planes joined back to back, converting the forward driving force into a sideways spreading force that separates the material apart. This differs from a screw, which converts rotational force into linear force instead. This same wedge-based conversion applies to any tool that splits or separates material.

34. A — Hydraulic mechanical advantage equals the output piston area divided by the input piston area: $20/2.5 = 8$. Subtracting the areas instead of dividing them ($20-2.5=17.5$) applies the wrong operation

entirely and produces the incorrect distractor shown in this question. Dividing output area by input area, not subtracting them, gives the true mechanical advantage.

35. B — Ohm's law states current equals voltage divided by resistance: $I = V/R = 18/6 = 3$ amps. Multiplying voltage by resistance instead of dividing ($18 \times 6 = 108$) inverts the correct operation and produces the 108-amp distractor shown in this question. Dividing voltage by resistance, not multiplying them, is the correct application of Ohm's law.

36. D — A parallel circuit connects every branch across the same two points, so each branch experiences the identical voltage from the source. This differs from current, which divides among the branches based on each branch's individual resistance rather than staying uniform throughout the circuit. This uniform-voltage behavior is exactly what distinguishes a parallel circuit from a series one.

37. C — Each additional series component adds its own resistance along the single shared path, so total resistance always increases as more components are added one after another. This is the opposite of a parallel circuit, where adding more branches actually decreases the combined total resistance instead. This additive resistance behavior is exactly what distinguishes a series circuit from a parallel one.

38. B — Conduction transfers heat through direct physical contact between materials, exactly as heat moves from a hot pipe into a hand touching it. Convection instead requires a circulating fluid or gas, and radiation requires no contact at all, making both different mechanisms from this direct-touch scenario. Recognizing which heat-transfer mode a scenario describes helps explain real equipment behavior clearly.

39. A — The continuity principle requires flow rate to remain constant, so when the pipe widens, the fluid slows down to maintain that same overall flow rate through the larger cross-sectional area. This is the reverse of what happens when a pipe narrows instead of widening. This inverse relationship between pipe width and fluid velocity follows directly from the continuity principle.

40. D — A gate valve is designed specifically for full-open or full-closed operation with little restriction when open, while a globe valve is designed for throttling and regulating flow across a range of partial positions instead. Using a gate valve for sustained throttling can damage its seal. Matching valve type to its intended function prevents premature wear on the sealing surface.

41. C — A coarse thread pitch covers more distance per rotation, which trades away mechanical advantage in exchange for faster advancement along the screw's axis. This mirrors the same force-for-distance trade-off found in every other simple machine covered throughout the mechanical reasoning chapters of this book. Fine threads reverse this trade-off, gaining advantage at the cost of more turns.

42. A — This is the same force-for-distance trade-off found in every simple machine: an inclined plane reduces the required force but increases the distance the load travels along the slope compared to lifting it straight up, with total work staying roughly the same aside from friction losses. This same trade-off between force and distance applies to every simple machine in this chapter.

43. D — The overall mechanical advantage of a compound machine is found by multiplying the individual mechanical advantages of its components: $4 \times 18 = 72$. Adding the two values instead

(4+18=22) is a common error, since compound advantage compounds multiplicatively, never additively, across its parts. Multiplying, rather than adding, the individual mechanical advantages gives the correct compound result.

44. B — An idler gear's own tooth count cancels out of the overall ratio calculation between the first and last gear in the train, meaning only the direction is affected. The speed and torque relationship between the first and last gear stays exactly what it would be without the idler present. Recognizing that only direction changes with an idler prevents this confusion.

45. B — Absolute pressure equals gauge pressure plus atmospheric pressure: $55 + 14.7 = 69.7$ psi. Reporting the gauge reading alone as the absolute pressure ignores that gauge pressure is measured relative to the surrounding atmosphere, not relative to a true vacuum, and must be adjusted accordingly. Adding the standard atmospheric constant to the gauge reading gives the correct absolute value.

46. A — Speed ratio equals the driving diameter divided by the driven diameter: $6/8 = 3/4$. Driven speed = $600 \times 3/4 = 450$ RPM. Multiplying instead of dividing by the diameter ratio ($600 \times 4/3$, rounded to 800) inverts the relationship and produces the incorrect distractor shown here. Dividing by the correct diameter ratio gives the true driven speed.

47. C — A second-class lever places the load between the fulcrum and the effort, exactly as in a wheelbarrow. A first-class lever instead places the fulcrum between effort and load, as in a seesaw, an arrangement that behaves quite differently in terms of mechanical advantage overall. Recognizing the fulcrum's position relative to load and effort confirms this lever classification quickly.

48. D — Static friction, which resists the start of motion, is generally greater than kinetic friction, which resists motion already underway, for the same pair of surfaces. This is why an object often takes more force to start moving than it does to keep moving once already sliding. Recognizing that friction persists, just in a smaller form, once motion begins is key.

49. C — An impact wrench uses a rotating hammer mechanism delivering rapid rotational impacts rather than smooth continuous torque, allowing very high peak torque from a lightweight motor. This differs meaningfully from a simple gear-reduction tool, which relies on continuous torque multiplication instead of repeated hammering impacts. This hammering mechanism is what distinguishes an impact wrench from a standard continuous-torque tool.

50. A — Weight measures the force of gravity acting on an object's mass, and gravity varies by location, such as being weaker on the moon than on Earth, so the same object weighs less there. Mass itself, the actual amount of matter present, stays constant everywhere it is measured. Mass and weight are related but genuinely distinct quantities.

51. B — The passage's central point connects the economizer's function, preheating feedwater with exhaust heat, directly to the stated benefit of improved efficiency. The other options either contradict the passage's stated benefit or deny a relationship the passage explicitly and directly describes. Recognizing how supporting details connect to one central claim is the core main-idea skill.

52. D — The passage requires both checks, the belt guard and free blade rotation, to be confirmed before power is restored. A missing guard does not satisfy the passage's stated condition; restoring power must wait until the guard check is also successfully completed first. Requiring both stated checks before proceeding is exactly what the passage's own wording demands.

53. B — The passage directly illustrates "anomalous" through the phrase "sharply different from every previous inspection on record," which describes a reading that deviates from the established normal pattern. This is a direct-illustration context clue rather than one requiring an outside contrasting comparison. Recognizing this kind of direct illustration is a fast, reliable way to determine word meaning.

54. C — The passage's cause-and-effect sequence, repacking the bearing followed immediately by temperature returning to normal, directly supports the inference that depleted grease was contributing to the elevated reading. The passage says nothing about motor replacement or any future maintenance schedule. This kind of direct cause-and-effect sequence is exactly what supports a valid inference here.

55. D — The passage states plainly that low intake pressure triggers the alarm, which exists to warn operators before the pump runs dry. Reversing this relationship, claiming the alarm causes the pressure drop, inverts the passage's actual stated cause-and-effect logic entirely. Demanding this kind of textual proof is what reliably defeats a reversed-logic distractor here.

56. A — The passage's overall point connects early detection through ultrasonic testing directly to avoiding unplanned failures through proactive, scheduled inspection. The other options either dismiss the passage's stated value of the practice or deny a connection it explicitly and directly makes. Recognizing how supporting details connect to one central claim is the core main-idea skill.

57. D — The passage lists four sequential steps: closing the suction valve first, closing the discharge valve second, venting pressure third, and verifying zero pressure last. The word "next" explicitly marks closing the discharge valve as the step that follows closing the suction valve. The sequence words in this passage explicitly mark which action comes immediately after which.

58. C — The passage directly defines "weep" through its own description: a slow, barely visible seepage, distinct from an active leak. This direct restatement is one of the clearest possible forms of a context clue, requiring no outside knowledge of plumbing terminology to answer correctly. Recognizing this kind of illustrative context clue is a fast, dependable reading strategy here.

59. B — The passage's sequence words "first" and "next" establish that confirming PPE and verifying depressurization both come before opening the line, which itself must be done slowly while facing away. Skipping either earlier step would violate this explicitly stated required order. Following the passage's explicit stated order, rather than assuming, is essential on this item type.

60. A — The passage's conditional statement is explicit: if the readings match within one degree, no adjustment is needed. Adjusting a thermostat that already reads within tolerance would apply an unnecessary step the passage's own stated condition clearly rules out in this specific scenario. Applying a stated condition exactly as written, rather than adding an extra step, is key.

61. A — The phrase "showing no measurable movement when tested by hand" directly defines "secure" here as firmly fastened, not loose, which is exactly what this specific word conveys given the surrounding sentence and the described hand test. Recognizing this kind of direct-illustration context clue takes careful, deliberate reading of the sentence.

62. D — The before-and-after comparison, installing a new belt followed by no further detected slippage, directly supports the inference that the old belt was the source of the problem. The passage never mentions a motor replacement anywhere in the text. This kind of clear cause-and-effect sequence is exactly what a valid inference should rest on.

63. B — The stated range is 60 to 70 ft-lbs inclusive, and 65 ft-lbs falls directly within that range. The other values sit just outside the range on either end, exactly the kind of near-miss numeric distractor this exam commonly uses to test careful, deliberate reading. Checking every specific numeric detail against the stated range, not just its shape, catches this.

64. C — The passage's overall point connects weekly testing directly to confirming the protective mechanism still functions, which is exactly what keeps the station ready for a real chemical exposure incident. The other options either contradict or ignore the passage's stated purpose entirely. Recognizing how two supporting details connect to one central protective purpose is the key skill.

65. D — The passage's conditional step, beginning work, applies only once both the tag and the remote-energizing check are confirmed. A verified tag alone does not satisfy this condition; work must wait until the remote-energizing requirement is also fully addressed. Applying the passage's stated condition exactly, rather than skipping ahead, is essential on this item.

66. B — The phrase "appearing at irregular intervals with no consistent pattern" directly defines "sporadic" here as occurring irregularly, the opposite of what a reader might otherwise assume without this specific surrounding context provided in the passage. No outside knowledge of the specific equipment is needed to determine this meaning correctly. This is a direct restatement, the clearest possible context clue.

67. A — The immediate resolution of the whining sound right after the coupling replacement directly supports the inference that the failing coupling was the source of the noise. The passage gives no information suggesting the motor, rather than the coupling, was the actual cause. This kind of immediate, direct cause-and-effect sequence is exactly what supports this valid inference.

68. C — The passage states plainly that a clogged filter increases resistance and can cause overheating. Reversing this relationship, claiming heat causes the filter to clog, inverts the passage's actual stated cause-and-effect direction entirely, a common reversed-logic trap on this question type. Demanding this kind of textual proof reliably defeats a reversed-logic distractor on this item type.

69. D — The passage directly connects both requirements, testing and a rescue plan, to two stated benefits, toxic exposure protection and rapid response. The other options either deny the passage's stated precautions or narrow the benefit to only one of the two the passage actually names. Recognizing how two stated benefits connect to one central protective purpose is the key skill.

70. A — The passage explicitly names tag number and completion date as what the work order specifies. A technician's certification number is never mentioned anywhere in the text, making it the one detail that cannot be supported by what the passage actually states. Searching the passage's exact wording, rather than assuming an unstated detail, catches this trap reliably.

71. C — The direct sequence, clearing the trap followed by fluctuations stopping entirely, supports the inference that the blocked trap was causing the pressure instability beforehand. The passage never mentions a boiler replacement or makes any claim about future maintenance needs. Recognizing this kind of borderline, edge-of-range numeric detail takes careful, deliberate reading here.

72. B — The passage lists three sequential actions ending with applying personal locks, which the word "then" marks as the final step before work begins, coming after isolating the breaker and testing for zero voltage in that specific stated order. Recognizing how two stated hazards connect to one central protective purpose is the key skill.

73. D — The passage directly defines short-cycling through its own description: rapidly starting and stopping rather than running a normal full cycle. This direct restatement is one of the clearest possible forms of a context clue available anywhere in this passage. Recognizing this kind of direct, illustrative definition is a clear, reliable form of context clue.

74. A — The stated range is $\frac{3}{8}$ ($\frac{6}{16}$) to $\frac{1}{2}$ ($\frac{8}{16}$) inch inclusive, and $\frac{7}{16}$ inch falls directly within that range. The other values sit just outside the range on either end, exactly the kind of near-miss numeric distractor this exam commonly uses to test careful reading. Checking the numeric detail against the stated range catches this trap.

75. B — The passage's central point connects the jumper's function, maintaining continuity across an interrupted pipe, directly to the stated benefit of preventing a spark hazard. The other options either reverse this stated benefit or contradict the specific scenario the passage actually describes. Recognizing how the passage's stated benefit connects to its underlying mechanism is the key skill.

76. C — A 90-degree clockwise rotation cycles each corner one position clockwise: top-right to bottom-right, bottom-right to bottom-left, bottom-left to top-left, and top-left back to top-right. Tracking this single marked corner through the cycle gives the correct new position directly and reliably. Tracking a single marked corner through the rotation, rather than the whole shape, gives this answer.

77. A — A 180-degree rotation moves every feature to its exact diagonal opposite position. A feature starting in the bottom-right corner therefore moves to the top-left corner, the corner diagonally across the shape from where it originally started before the rotation was applied. Tracking a single marked corner through a full half-turn gives its exact diagonal opposite position.

78. B — A reflection across a horizontal axis flips a shape's top-to-bottom orientation but does not change its left-right position at all. A tab on the left edge stays on the left edge after this specific reflection; only its vertical position within that edge would actually change. Recognizing that a horizontal-axis reflection only affects top-bottom position, not left-right, is the key insight.

79. C — In the four-square column Q-P-R-U, the first and third squares become opposite faces (Q and R), and the second and fourth squares become opposite faces (P and U). Tracing this same column-position rule confirms that face P ends up opposite face U once folded into the finished cube. The same rule applies to any four-square column in a valid net.

80. D — With Q and R already opposite, and P and U already opposite, from the four-square vertical column, the two remaining squares, S and T, attached to the sides of the central square P, become the cube's final pair of opposite faces once the whole net is folded. Identifying the two leftover squares confirms this remaining opposite pair.

81. D — Because the hole appears only in the front view and creates no opening in the top or side views, it cannot extend through the object in those directions; a hole passing all the way through in another direction would also appear in the view looking directly into that path. Confirming which views show a feature prevents this misread.

82. B — Because the notch appears consistently in both the top view and the side view, but not in the front view, the modification must be a corner cut into the top surface of the object, visible from any angle that looks down onto or across that top surface. Matching positions across two views reveal the true orientation.

83. A — A 270-degree clockwise rotation equals three consecutive 90-degree clockwise steps. Tracking the corner through each step, bottom-left to top-left, to top-right, to bottom-right, shows it ends in the bottom-right corner after the full 270-degree rotation is complete. Tracking a single marked corner through three consecutive quarter-turns gives this final position directly.

84. C — A reflection across a vertical axis flips a shape left-to-right but does not change its top-to-bottom position at all. A tab on the top edge stays on the top edge after this specific reflection; only its left-right position within that edge would actually change. Recognizing that a vertical-axis reflection only affects left-right position, not top-bottom, is the key insight.

85. D — A rectangular box has six faces total, arranged as three pairs of opposite, identically-sized faces: top/bottom, front/back, and left/right. Every valid box net, regardless of its specific layout, always folds into exactly these three matching pairs, never more and never fewer than that. Counting each pair of matching faces, rather than each individual square, confirms this specific total.

86. B — A scale of 1:30 means every unit on the drawing represents 30 of that same unit in reality. Multiply the drawing measurement by the scale factor: $5 \times 30 = 150$ centimeters. Adding instead of multiplying ($5+30=35$) misapplies the scale as an offset rather than a true multiplying ratio. Multiplying by the scale factor, not adding, gives the true length.

87. C — The long-short-long dash pattern is the standard convention for a center line, used specifically to mark the central axis of round features like holes and cylinders. A hidden edge instead uses a simple, evenly spaced dashed line, a visibly different pattern from the center-line convention. Distinguishing this line type from the solid and dashed line conventions covered elsewhere matters here.

88. A — A 90-degree counterclockwise rotation moves each corner one position in the reverse direction of a clockwise rotation, following the cycle top-left to bottom-left to bottom-right to top-right. Starting at top-left, the next counterclockwise step lands directly at bottom-left. Tracking a single marked corner through the counterclockwise cycle gives this new position directly.

89. C — Because the two circles appear in matching vertical positions in both the front view and the side view, both of which look along or across that same front-to-back path, the holes must run through the object from front to back, stacked one above the other. Confirming which two views show matching circle positions reveals the hole's true orientation clearly.

90. A — A 90-degree clockwise rotation cycles edges the same way it cycles corners: bottom moves to left, left moves to top, top moves to right, and right moves to bottom. Tracking this one marked edge through the cycle gives the correct new position directly and reliably. Tracking a single marked edge through the clockwise cycle gives its new position.

91. B — A valid cube net requires each of its six squares to fold into a distinct, non-overlapping face. Two squares folding to occupy the same face location makes the net structurally invalid, regardless of the fact that it happens to contain the technically correct total square count. A cube always requires exactly six faces, the key rule tested.

92. D — A reflection flips a shape's handedness entirely, the way a printed letter becomes backward in a mirror, which no amount of rotation can ever reproduce, since rotation always preserves a shape's original handedness no matter how far the shape is actually turned around. Recognizing that rotation always preserves handedness, while reflection always reverses it, is key here.

93. D — A 180-degree rotation moves every edge to its directly opposite edge. The edge directly opposite the right edge of a rectangle is the left edge, which is exactly where the shaded mark appears after the full half-turn rotation has been applied to the shape. Tracking a single marked edge through a full half-turn gives its exact opposite position directly.

94. A — A cube has exactly six faces, so any valid net must contain exactly six squares, no more and no fewer. With only three squares present, three entire faces of the finished cube would simply be missing, regardless of how those three squares happen to be folded together. A cube always requires exactly six faces, never fewer.

95. C — A 90-degree clockwise rotation cycles edges clockwise: left moves to top, top moves to right, right moves to bottom, and bottom moves to left. Tracking this one marked edge through the cycle shows it moves from the left edge to the top edge after the full rotation. This positioning allows dimensions to be cross-checked between views.

96. B — The standard orthographic layout places the top view directly above the front view and the side view directly beside it, allowing a reader to align matching width and depth dimensions between views by looking straight down or straight across between the related drawings on the page. Verifying against the original source drawing, rather than guessing, resolves this discrepancy correctly here.

97. B — Two accurate views of the same real feature should show consistent dimensions; a genuine mismatch is a real discrepancy that should be verified against the source drawing or confirmed with a supervisor, not resolved by simply guessing which of the two values happens to be correct. Tracking the corner through a full half-turn gives its diagonal opposite.

98. C — A 180-degree rotation moves every feature to its exact diagonal opposite corner. The corner diagonally opposite the top-left corner of a square or rectangle is the bottom-right corner, which is exactly where the shaded mark ends up after the full half-turn rotation is applied. Counting every square in the described arrangement carefully confirms this net's total face count.

99. A — Counting carefully: the horizontal row itself contains four squares, plus one square above the third and one square below the second, for a total of six squares, each sharing exactly one edge with a neighboring square and none overlapping, making this a genuinely valid cube net. Maintaining a consistent, proven method under time pressure protects accuracy on remaining questions here.

100. D — The single-feature tracking method covered throughout this chapter remains fast enough to be the best approach even under time pressure; abandoning it for random guessing sacrifices real accuracy on items that are still genuinely answerable within whatever time actually remains. This same restart-from-the-original-figure habit applies equally to rotation, folding, and view-assembly items.