PRACTICE EXAM 9: ALEKS PPL SIMULATION

1. Which of the following represents a function?

A. A circle on the coordinate plane

B. A vertical line

C. The equation $y = x^2 - 4$

D. The set $\{(1, 2), (1, 3), (2, 4)\}$

2. A sample of 200 people was surveyed; 80 preferred tea, 95 preferred coffee, and the rest preferred neither. What percentage preferred neither?

A. 15%

B. 12.5%

C. 20%

D. 25%

3. Simplify: $(x^3 + 2x^2 - x - 2)/(x + 2)$, assuming $x \neq -2$.

A. $x^2 - 2x + 1$

B. $x^2 + 1$

C. $x^2 + 2x + 1$

D. $x^2 - 1$

4. If the graph of f(x) is shifted 2 units to the left and 3 units up, what function represents the new graph?

A. $f(x + 2) + 3$

B. $f(x - 2) + 3$

C. $f(x + 2) - 3$

D. $f(x - 2) - 3$

5. A sphere's volume is 36π cm^3. What is its radius?

A. 2 cm

B. 6 cm

C. 3 cm

D. 9 cm

6. Solve: $3(x - 1) \geq 2x + 4$.

A. $x \geq 1$

B. $x \leq 7$

C. $x \geq 5$

D. $x \geq 7$

7. A right triangle has an angle of 45° and one leg of 8. What is the hypotenuse?

A. $8\sqrt{2}$

B. $8\sqrt{3}$

C. 16

D. $4\sqrt{2}$

8. The 8th term of an arithmetic sequence is 29, and the common difference is 3. What is the first term?

A. 5

B. 8

C. 11

D. 14

9. Simplify: $\sqrt[3]{(64x^9y^6)}$, assuming variables are positive.

A. $4x^2y^2$

B. $4x^3y^6$

C. $8x^3y^2$

D. $4x^3y^2$

10. If $x^2 - 5x + c = 0$ has a solution of $x = 2$, what is the value of c?

A. -2

B. 4

C. 6

D. 10

11. A movie ticket costs $12 for adults and $8 for children. If 35 tickets were sold for a total of $356, how many child tickets were sold?

A. 16

B. 14

C. 21

D. 19

12. What is the solution set for $x^2 \leq 16$?

A. $x \leq 4$

B. $x \geq -4$

C. $-4 \leq x \leq 4$

D. $x \leq -4$ or $x \geq 4$

13. The graph of $y = |x|$ is reflected over the x-axis. What is the new equation?

A. $y = |-x|$

B. $y = -|x|$

C. $y = |x - 1|$

D. $y = |x| + 1$

14. Evaluate: $\sqrt{(49)} - \sqrt{(25)} + \sqrt{(100)}$.

A. 8

B. 10

C. 11

D. 12

15. A rectangle's length is increased by 20% and its width is decreased by 20%. By what percent does the area change?

A. 4% decrease

B. 0% (no change)

C. 4% increase

D. 20% decrease

16. Simplify: $(\sin \theta)(\csc \theta) + \cos^2\theta$.

A. $\sin^2\theta + \cos^2\theta$

B. $\tan \theta$

C. $1 + \cos^2\theta$

D. 2

17. Solve for x: 4^(x) = 2^(x + 3).

A. $x = 1$

B. $x = 2$

C. $x = 3/2$

D. $x = 3$

18. Find the slope of the line connecting (a, 2a) and (3a, 4a), where $a \neq 0$.

A. 1

B. 2

C. 1/2

D. a

19. A ladder 13 feet long leans against a wall. If its base is 5 feet from the wall, how high up the wall does the ladder reach?

A. 8 feet

B. 12 feet

C. 15 feet

D. 18 feet

20. Simplify: $(3 + i)(2 - 4i)$, where $i^2 = -1$.

A. $6 + 10i$

B. $6 - 10i$

C. $10 + 10i$

D. $10 - 10i$

21. A population $P(t) = 500 \cdot 2^{(t/4)}$ represents the number of bacteria after t hours. How many bacteria are present at $t = 8$ hours?

A. 500

B. 1000

C. 1500

D. 2000

22. The roots of a quadratic equation are 3 and −5. Which equation has these roots?

A. $x^2 + 2x - 15 = 0$

B. $x^2 - 2x - 15 = 0$

C. $x^2 + 2x + 15 = 0$

D. $x^2 - 2x + 15 = 0$

23. If $f(x) = x^2 + 2x$ and $g(x) = x - 1$, what is $(f - g)(2)$?

A. 5

B. 6

C. 7

D. 8

24. A pyramid has a square base of side 6 and a height of 10. What is its volume?

A. 60

B. 120

C. 180

D. 360

25. What is the range of $f(x) = 3 - (x - 1)^2$?

A. $y \geq 3$

B. $y \leq 1$

C. $y \geq 1$

D. $y \leq 3$

26. Simplify: $(x + 2)/x - 3/(x + 2)$, assuming $x \neq 0, -2$.

A. $(x^2 + x + 4)/[x(x + 2)]$

B. $(x^2 - x + 4)/[x(x + 2)]$

C. $(x - 1)/[x(x + 2)]$

D. $(x^2 + 7x + 4)/[x(x + 2)]$

27. The equation $y = 2^x$ passes through which of the following points?

A. (0, 0)

B. (3, 8)

C. (2, 6)

D. (−1, 2)

28. A driver travels 180 miles at 60 mph, then another 180 miles at 45 mph. What is the average speed for the entire trip?

A. 52 mph

B. 50 mph

C. 54 mph

D. ≈ 51.43 mph

29. Find the value of x if 9^(x − 1) = 27.

A. 2

B. 2.25

C. 2.5

D. 3

30. A cone and a cylinder have equal radii and equal heights. If the cylinder's volume is 90 cm^3, what is the cone's volume?

A. 30 cm^3

B. 45 cm^3

C. 60 cm^3

D. 90 cm^3

PRACTICE EXAM 9: ANSWER KEY AND EXPLANATIONS

1. C — A function assigns each input to exactly one output. The equation $y = x^2 - 4$ passes the vertical line test and produces one y-value for every x. Circles fail the vertical line test, vertical lines fail it trivially, and the set with $x = 1$ producing two y-values violates the function definition.

2. B — Calculate those preferring neither: $200 - 80 - 95 = 25$ people. Percent = $25/200 = 0.125 = 12.5\%$. Always subtract known categories from the total before computing the percentage of the remainder.

3. D — Factor the numerator by grouping: $x^2(x + 2) - 1(x + 2) = (x + 2)(x^2 - 1)$. Cancel the common factor $(x + 2)$: result is $x^2 - 1$. Grouping is the standard factoring method for four-term polynomials.

4. A — Horizontal shifts work opposite to the sign inside the function: $(x + 2)$ shifts left by 2. Vertical shifts work in the direction of the sign outside: +3 shifts up by 3. Combined: $f(x + 2) + 3$. Always remember the opposite-direction rule for horizontal shifts.

5. C — Volume of a sphere = $(4/3)\pi r^3$. Set $(4/3)\pi r^3 = 36\pi$, giving $r^3 = 27$ and $r = 3$ cm. Always divide by $(4/3)\pi$ before taking the cube root. Cube roots preserve the sign of the radicand.

6. D — Distribute: $3x - 3 \geq 2x + 4$. Subtract 2x: $x - 3 \geq 4$. Add 3: $x \geq 7$. Since we are not multiplying or dividing by a negative, the inequality direction stays the same.

7. A — In a 45-45-90 triangle, the two legs are equal and the hypotenuse is leg $\times \sqrt{2}$. With leg = 8, hypotenuse = $8\sqrt{2}$. The 45-45-90 ratio $(1 : 1 : \sqrt{2})$ is one of the two essential special-triangle ratios to memorize.

8. B — Use the formula $a_n = a_1 + (n - 1)d$. For the 8th term: $29 = a_1 + 7(3) = a_1 + 21$, giving $a_1 = 8$. Always substitute directly into the explicit formula to isolate the first term.

9. D — Cube root of 64 is 4; cube root of x^9 is x^3 (divide exponent by index 3); cube root of y^6 is y^2 (divide 6 by 3). Combined: $4x^3y^2$. Always divide each variable's exponent by the radical index when extracting.

10. C — Substitute $x = 2$ into the equation: $(2)^2 - 5(2) + c = 0$, giving $4 - 10 + c = 0$ and $c = 6$. If a value is a solution, it must satisfy the equation — substitution reveals the unknown coefficient.

11. A — Let c = child tickets; adult tickets = $35 - c$. Revenue: $12(35 - c) + 8c = 356$, giving $420 - 12c + 8c = 356$ and $-4c = -64$, so $c = 16$. Two-variable word problems benefit from expressing both quantities in one variable.

12. C — $x^2 \leq 16$ means $|x| \leq 4$, which is equivalent to $-4 \leq x \leq 4$. Quadratic inequalities of the form $x^2 \leq k$ produce a bounded interval between the positive and negative square roots. Always include both endpoints when the inequality is $\leq$.

13. B — Reflecting over the x-axis negates every y-value: $y = |x|$ becomes $y = -|x|$. Reflections across the x-axis always introduce a leading negative sign on the entire function expression.

14. D — $\sqrt{49} = 7$, $\sqrt{25} = 5$, $\sqrt{100} = 10$. Compute: $7 - 5 + 10 = 12$. Always evaluate each radical as a perfect square separately before combining with addition and subtraction.

15. A — If original length and width are L and W, original area is LW. New area: $(1.20L)(0.80W) = 0.96LW$. Change: $-0.04LW = 4\%$ decrease. Sequential percent changes compound multiplicatively — they do not cancel.

16. C — $\sin\theta \times \csc\theta = \sin\theta \times (1/\sin\theta) = 1$. So the expression becomes $1 + \cos^2\theta$. Reciprocal identities always simplify to 1 when a function is multiplied by its reciprocal, regardless of the value of θ.

17. D — Rewrite 4 as 2^2: $(2^2)^x = 2^{(x + 3)}$, giving $2^{(2x)} = 2^{(x + 3)}$. Equate exponents: $2x = x + 3$, so $x = 3$. Always convert to a common base before equating exponents.

18. A — Slope $= (4a - 2a)/(3a - a) = 2a/2a = 1$, for $a \neq 0$. Variables cancel cleanly when identical factors appear in both numerator and denominator. The slope is constant regardless of the specific value of a.

19. B — By the Pythagorean theorem: $5^2 + h^2 = 13^2$, giving $h^2 = 169 - 25 = 144$ and $h = 12$ feet. Recognize the (5, 12, 13) triple to eliminate the calculation entirely.

20. D — Apply FOIL: $(3)(2) + (3)(-4i) + (i)(2) + (i)(-4i) = 6 - 12i + 2i - 4i^2 = 6 - 10i + 4 = 10 - 10i$. Since $i^2 = -1$, the $-4i^2$ term becomes $+4$. Always simplify i^2 after multiplying through.

21. D — $P(8) = 500 \times 2^{(8/4)} = 500 \times 2^2 = 500 \times 4 = 2000$. Exponential functions require evaluating the exponent first, then the base power, then multiplying by the coefficient.

22. A — If roots are 3 and -5, the factored form is $(x - 3)(x + 5) = 0$. Expand: $x^2 + 5x - 3x - 15 = x^2 + 2x - 15 = 0$. The sum of roots is $-b/a$; the product is c/a. Use these relations to verify quickly.

23. C — $(f - g)(2) = f(2) - g(2) = (4 + 4) - (2 - 1) = 8 - 1 = 7$. Evaluate each function separately at $x = 2$, then subtract. Always apply order of operations inside each function before combining.

24. B — Volume of pyramid $= (1/3) \times$ base area $\times$ height $= (1/3)(36)(10) = 120$. Pyramids and cones both use the (1/3) factor — this distinguishes "pointed" solids from prisms and cylinders.

25. D — The vertex of $f(x) = 3 - (x - 1)^2$ is (1, 3), and the parabola opens downward because of the negative leading sign. Maximum value is 3; the range extends downward without bound, giving $y \leq 3$.

26. A — LCD is $x(x + 2)$. Rewrite: $(x + 2)^2/[x(x + 2)] - 3x/[x(x + 2)] = [(x + 2)^2 - 3x]/[x(x + 2)] = (x^2 + 4x + 4 - 3x)/[x(x + 2)] = (x^2 + x + 4)/[x(x + 2)]$. Always expand and combine all terms in the numerator before simplifying.

27. B — Substitute $x = 3$: $2^3 = 8$. So $(3, 8)$ satisfies $y = 2^x$. Exponential functions grow rapidly; checking candidate points by direct substitution is the fastest verification method.

28. D — Total distance = 360 miles. Total time = $180/60 + 180/45 = 3 + 4 = 7$ hours. Average speed = $360/7 \approx 51.43$ mph. Average speed is total distance divided by total time, never the arithmetic mean of rates.

29. C — Rewrite 9 as 3^2 and 27 as 3^3: $(3^2)^(x - 1) = 3^3$, giving $3^(2x - 2) = 3^3$. Equate exponents: $2x - 2 = 3$, so $x = 5/2 = 2.5$. Matching bases reveals the exponent relationship directly.

30. A — Cone volume is (1/3) of the cylinder volume when both have the same radius and height: $90 \div 3 = 30$ cm^3. This one-third relationship is universal for pointed solids versus their prism or cylinder counterparts.