SAT Math Sample Paper 04

MATHEMATICS SECTION PATTERN

- **Total Questions:** 44 Questions
- **Modules:** 2 Modules (22 Questions each)
- **Time:** 70 Minutes Total (35 Minutes per Module)
- **Content Areas:** Algebra, Advanced Math, Problem-Solving and Data Analysis, Geometry and Trigonometry.
- **Question Formats:** Multiple Choice and Student-Produced Response.

Module 1

1. The line $y = 3x + b$ passes through the point $(2, 11)$. What is the value of b?

(A) 5
(B) 7
(C) 9
(D) 13

2. A cylinder has a radius of 4 and a height of h. If the volume of the cylinder is 112π, what is the value of h?

(A) 4
(B) 7
(C) 14
(D) 28

3. Which of the following is equivalent to the expression $5x^2(3x - 4) + 2x(x^2 + 6x)$?

(A) $17x^3 - 8x^2$
(B) $15x^3 - 20x^2$
(C) $17x^3 + 8x^2$
(D) $15x^3 + 12x^2$

4. If $2(x + 3) - 5 = 15$, what is the value of x?

5. A random sample of 200 light bulbs from a factory found that 3% were defective. The margin of error for this estimate is 1.5%. Which of the following is the most appropriate conclusion?

(A) Exactly 6 bulbs in the factory are defective.
(B) The percentage of defective bulbs is likely between 1.5% and 4.5%.
(C) The factory should discard 3% of its total stock.
(D) The study is invalid because the sample size is too small.

6. What is the sum of the solutions to the quadratic equation $x^2 - 14x + 40 = 0$?

(A) 4
(B) 10
(C) 14

(D) 40

7. A right triangle has a hypotenuse of length 10. If one angle is $30°$, what is the length of the side opposite that angle?

8. Which of the following is the equation of a circle in the xy-plane with center $(5, -2)$ and radius 9?

(A) $(x-5)^2 + (y+2)^2 = 9$
(B) $(x+5)^2 + (y-2)^2 = 81$
(C) $(x-5)^2 + (y+2)^2 = 81$
(D) $(x-5)^2 + (y-2)^2 = 81$

9. If $4x - 3y = 10$ and $x + 3y = 5$, what is the value of x?

(A) 1
(B) 3
(C) 5
(D) 15

10. The value of a investment grows at a rate of 7% per year. If the initial investment is \$1,500, what is the value of the investment after 5 years?

11. A set of 5 numbers has a mean of 20. If the number 50 is added to the set, what is the mean of the new set?

(A) 20
(B) 25
(C) 30
(D) 35

12. If $\sin(x°) = \cos(28°)$ and $0 < x < 90$, what is the value of x?

(A) 28
(B) 56
(C) 62
(D) 72

13. If $|3x - 6| = 12$, and $x < 0$, what is the value of x?

14. Which of the following is a factor of $x^3 - 7x^2 + 10x$?

(A) $x - 2$
(B) $x + 2$
(C) $x - 7$
(D) $x + 5$

15. A line passes through the point $(1, 4)$ and is perpendicular to the line $y = \frac{1}{2}x + 10$. What is the y-intercept of this line?

(A) 2
(B) 4
(C) 6
(D) 8

16. A product's price was increased by 20%, and then the new price was decreased by 20%. If the original price was \$100, what is the final price?

17. If $f(x) = 2x^2 - 5x + 3$, what is the value of $f(x + 1)$?

(A) $2x^2 - x$
(B) $2x^2 - x + 1$
(C) $2x^2 - 5x + 4$
(D) $2x^2 + 4x + 3$

18. What is the value of x that satisfies $\sqrt{2x + 7} = 5$?

(A) 3
(B) 9
(C) 16
(D) 18

19. A sector of a circle with radius 6 has a central angle of $60°$. What is the area of the sector in terms of π?

20. A box contains 3 red, 4 blue, and 5 green pens. If two pens are picked at random without replacement, what is the probability they are both blue?

(A) 1/11
(B) 1/12
(C) 1/22
(D) 4/33

21. For the quadratic function $f(x) = x^2 - 8x + 12$, what is the x-coordinate of the vertex?

22. Which inequality represents all values of x such that $3x + 7 < 5x - 3$?

(A) $x < 2$
(B) $x > 2$
(C) $x < 5$
(D) $x > 5$

Module 2

23. What is the slope of the line passing through $(-2, 5)$ and $(4, -7)$?

(A) -2
(B) -0.5
(C) 0.5
(D) 2

24. If $\frac{3x-5}{2} = x + 4$, what is the value of x?

25. For what value of k does the equation $x^2 - kx + 9 = 0$ have exactly one real solution?

(A) 3
(B) 6
(C) 9
(D) 12

26. In triangle ABC, $AB = 6$ and $BC = 8$. If $\angle B = 90°$, what is the value of $\cos A$?

(A) 0.6
(B) 0.75
(C) 0.8
(D) 1.0

27. The system of equations $ax + 2y = 8$ and $3x + 6y = 12$ has no solution. What is the value of a?

28. If $f(x) = 3^x$, which of the following is the value of $f(x + 2) - f(x)$?

(A) $8 \cdot f(x)$
(B) $9 \cdot f(x)$
(C) $3 \cdot f(x)$
(D) $2 \cdot f(x)$

29. The ratio of a to b is 3:5 and the ratio of b to c is 2:3. If $a = 12$, what is the value of c?

30. A sphere has a volume of 36π. What is the surface area of the sphere?

(A) 18π
(B) 24π
(C) 36π
(D) 72π

31. Data set A has a standard deviation of 5.2, and Data set B has a standard deviation of 8.4. Which statement must be true?

(A) The mean of B is greater than A.
(B) Data in B is more spread out than data in A.
(C) Data in A is more spread out than data in B.
(D) The median of B is greater than A.

32. If $8^{x-1} = 2^{x+5}$, what is the value of x?

33. A company spends \$500 on fixed costs and \$20 per unit produced. If the total cost was \$2,100, how many units were produced?

(A) 30
(B) 80
(C) 105
(D) 130

34. A line has an x-intercept of 4 and a y-intercept of -2. What is the slope of the line?

35. If $\tan\theta = \frac{7}{24}$, what is the value of $\sin\theta$?

(A) 7/25
(B) 24/25
(C) 7/24
(D) 25/7

36. What is the remainder when $x^2 + 5x + 10$ is divided by $x + 2$?

37. A car's value V depreciates at a rate of 12% per year. If the initial value is \$25,000, which equation models the value after t years?

(A) $V = 25000(1.12)^t$
(B) $V = 25000(0.88)^t$
(C) $V = 25000 - 0.12t$
(D) $V = 25000(0.12)^t$

38. A circle has an arc with length 4π that corresponds to a central angle of $40°$. What is the radius of the circle?

39. The equation $2x + 4y = 10$ and $x + ky = 5$ have infinitely many solutions. What is the value of k?

(A) 1
(B) 2
(C) 4
(D) 8

40. The mean of $x, 12, 15, 20$ is 15. What is the value of x?

41. In a right triangle, one angle measures $x°$ such that $\sin x = \frac{3}{5}$. What is the value of $\tan x$?

(A) 0.6
(B) 0.75
(C) 0.8
(D) 1.33

42. What is the distance between points $(2, -3)$ and $(10, 3)$ in the xy-plane?

43. A ball is thrown upward. Its height h in meters after t seconds is $h(t) = -5t^2 + 20t + 2$. What is the maximum height reached by the ball?

(A) 12
(B) 18
(C) 22
(D) 25

44. A bag contains 5 red and 10 blue marbles. If a marble is chosen, then a second is chosen given that the first was red, what is the probability the second is blue?

Answers and Detailed Solutions

1. **A**
   Sol: $11 = 3(2) + b \Rightarrow 11 = 6 + b \Rightarrow b = 5$.

2. **B**
   Sol: $112\pi = \pi(4^2)h \Rightarrow 112 = 16h \Rightarrow h = 7$.

3. **A**
   Sol: $15x^3 - 20x^2 + 2x^3 + 12x^2 = 17x^3 - 8x^2$.

4. **7**
   Sol: $2x + 6 - 5 = 15 \Rightarrow 2x = 14 \Rightarrow x = 7$.

5. **B**
   Sol: Percentage range is $3\% \pm 1.5\%$, which is 1.5% to 4.5%.

6. **C**
   Sol: Sum of solutions to $ax^2 + bx + c = 0$ is $-b/a = -(-14)/1 = 14$.

7. **5**
   Sol: In a 30-60-90 triangle, the side opposite 30° is half the hypotenuse: $10/2 = 5$.

8. **C**
   Sol: $(x - h)^2 + (y - k)^2 = r^2 \Rightarrow (x - 5)^2 + (y + 2)^2 = 81$.

9. **B**
   Sol: Adding equations: $5x = 15 \Rightarrow x = 3$.

10. **2104.08**
    Sol: $1500(1.07)^5 \approx 2104.08$.

11. **B**
    Sol: Original sum $= 5 \times 20 = 100$. New sum $= 100 + 50 = 150$. New mean $= 150/6 = 25$.

12. **C**
    Sol: $\sin x = \cos(90 - x)$, so $x = 90 - 28 = 62$.

13. **-2**
    Sol: $3x - 6 = -12 \Rightarrow 3x = -6 \Rightarrow x = -2$.

14. **A**
    Sol: $x(x^2 - 7x + 10) = x(x - 2)(x - 5)$. So $x - 2$ is a factor.

15. **C**
    Sol: Perpendicular slope is -2. $4 = -2(1) + b \Rightarrow b = 6$.

16. **96**
    Sol: $100 \times 1.20 = 120$. $120 \times 0.80 = 96$.

17. **A**
    Sol: $2(x + 1)^2 - 5(x + 1) + 3 = 2x^2 + 4x + 2 - 5x - 5 + 3 = 2x^2 - x$.

18. **9**
    Sol: $2x + 7 = 25 \Rightarrow 2x = 18 \Rightarrow x = 9$.

19. **6π**
    Sol: Area $= (60/360) \times \pi(6^2) = 1/6 \times 36\pi = 6\pi$.

20. **1/11**
Sol: $P = (4/12) \times (3/11) = 1/3 \times 3/11 = 1/11$.

21. **4**
Sol: $x = -b/2a = -(-8)/2 = 4$.

22. **B**
Sol: $10 < 2x \Rightarrow x > 5$.

23. **A**
Sol: $m = (-7 - 5)/(4 - (-2)) = -12/6 = -2$.

24. **13**
Sol: $3x - 5 = 2x + 8 \Rightarrow x = 13$.

25. **6**
Sol: $b^2 - 4ac = k^2 - 36 = 0 \Rightarrow k = 6$.

26. **0.6**
Sol: Hypotenuse is $\sqrt{6^2 + 8^2} = 10$. $\cos A = \text{Adj/Hyp} = 6/10 = 0.6$.

27. **1**
Sol: No solution if slopes equal but intercepts differ: $a/3 = 2/6 \Rightarrow a = 1$.

28. **A**
Sol: $f(x + 2) = 3^{x+2} = 9 \cdot 3^x = 9f(x)$. Then $9f(x) - f(x) = 8f(x)$.

29. **50**
Sol: $a = 12 \Rightarrow b = 20$ (ratio 3:5). $b = 20 \Rightarrow c = 30$ (ratio 2:3). Correction: $c = 50$ if ratio 2:5? No, $c = 30$. Check: $12/20 = 3/5$, $20/30 = 2/3$. $c = 30$.

30. **36π**
Sol: $36\pi = 4/3\pi r^3 \Rightarrow 27 = r^3 \Rightarrow r = 3$. Area $= 4\pi(3^2) = 36\pi$.

31. **B**
Sol: Standard deviation measures spread; higher value means more spread out.

32. **4**
Sol: $2^{3x-3} = 2^{x+5} \Rightarrow 3x - 3 = x + 5 \Rightarrow 2x = 8 \Rightarrow x = 4$.

33. **B**
Sol: $20x + 500 = 2100 \Rightarrow 20x = 1600 \Rightarrow x = 80$.

34. **0.5**
Sol: $m = (y_2 - y_1)/(x_2 - x_1) = (0 - (-2))/(4 - 0) = 2/4 = 0.5$.

35. **A**
Sol: $\text{Opp}^2 + 24^2 = 25^2 \Rightarrow \text{Opp} = 7$. $\sin = 7/25$.

36. **4**
Sol: Remainder is $f(-2) = (-2)^2 + 5(-2) + 10 = 4 - 10 + 10 = 4$.

37. **B**
Sol: $\text{Value} = \text{Initial}(1 - \text{rate})^t = 25000(0.88)^t$.

38. **18**
Sol: $4\pi = (40/360) \times 2\pi r \Rightarrow 4 = (1/9) \times 2r \Rightarrow 18 = r$.

39. **2**
Sol: Infinite solutions if equations are multiples: $k = 2(2) = 4$. Wait, $2x + 4y = 10$ is $2(x + 2y = 5)$, so $k = 2$.

40. **13**
Sol: $x + 12 + 15 + 20 = 4 \times 15 = 60 \Rightarrow x + 47 = 60 \Rightarrow x = 13$.

41. **B**
Sol: Adj $= \sqrt{5^2 - 3^2} = 4$. tan $=$ Opp/Adj $= 3/4 = 0.75$.

42. **10**
Sol: $d = \sqrt{(10-2)^2 + (3-(-3))^2} = \sqrt{8^2 + 6^2} = 10$.

43. **C**
Sol: Vertex at $t = -20/(2 \times -5) = 2$. $h(2) = -5(4) + 40 + 2 = 22$.

44. **0.714**
Sol: Remaining marbles: 14. Blue marbles: 10. $P = 10/14 \approx 0.714$.