

KCATM 2011
11th Grade Algebraic Equations

1. Solve the quadratic equation: $3x^2 - 13x + 4 = 0$.

- (A) $\frac{13 \pm \sqrt{217}}{6}$ (B) $\frac{13 \pm \sqrt{217}}{3}$ (C) $4, \frac{1}{3}$ (D) $-\frac{1}{3}, -4$ (E) $0, \frac{26}{3}$

2. Solve the equation: $4(x-17)^2 = 96$.

- (A) $17 \pm 2\sqrt{6}$ (B) $-17 \pm 2\sqrt{23}$ (C) $-17 \pm 2\sqrt{6}$ (D) $17 \pm 2\sqrt{23}$ (E) 12, 22

3. Solve the equation: $2(y-4) = -3(y-5) + 5(y-8)$.

- (A) No Solution (B) All Real Numbers (C) $\frac{47}{6}$ (D) 0 (E) 4

4. Solve the equation: $5 + 3\sqrt{3x-4} = 26$

- (A) No Solution (B) $\frac{53}{3}$ (C) $\frac{11}{3}$ (D) $\frac{4 \pm \sqrt{7}}{3}$ (E) 15

5. Solve the equation: $|3x+5| = |x|$

- (A) $\frac{-5}{2}$ (B) $\frac{-5}{2}, \frac{-5}{4}$ (C) $\frac{-5}{4}$ (D) $\frac{5}{2}, -\frac{5}{2}$ (E) $\frac{5}{4}, -\frac{5}{4}$

6. Solve the inequality: $|3x-4| \leq -7$

- (A) No Solution (B) All Real Numbers (C) $(-\infty, -1]$ (D) $[11/3, \infty)$ (E) c and d

7. Solve the inequality: $2|x-3| - 15 < -11$

- (A) No Solution (B) All Real Numbers (C) (1,5) (D) [1, 5] (E) $(-\infty, 5)$

8. Solve the inequality, and write your answer in interval notation: $x^2 - 9 \geq 0$

- (A) $(-\infty, -3]$ (B) $[3, \infty)$ (C) a and b (D) $[-3, 3]$ (E) $(-3, 3)$

9. Solve the inequality, and write your answer in interval notation: $\log_2(5x) > 1$

- (A) $(-\infty, \frac{1}{5})$ (B) $(-\infty, \frac{2}{5})$ (C) $(\frac{2}{5}, \infty)$ (D) $(\frac{1}{5}, \infty)$ (E) $(-\infty, \infty)$

10. Solve the equation: $\ln(x) + \ln(x-3) = \ln(10)$

- (A) 5, -2 (B) 5 only (C) -2 only (D) no solution (E) e^5

11. Solve the equation: $\frac{2}{x+1} - \frac{5}{x-1} = \frac{7}{x^2-1}$

- (A) 14/3 (B) -4/3 (C) 10/3 (D) -14/3 (E) 4/3

12. Find the value of y in the following system: $\begin{cases} 3x+5y=17 \\ 2x-4y=-2 \end{cases}$

- (A) 29/11 (B) 1 (C) no solution (D) 4 (E) 20/11

13. Solve for B: $A = \frac{1}{2}h(b+B)$.

- (A) $\frac{2A}{h} - B$ (B) $\frac{2A-hb}{h}$ (C) answer not given (D) no solution (E) $\frac{A}{2h} - b$

14. Solve for y: $x = \frac{2y-1}{y+3}$.

- (A) $\frac{3x+1}{x-2}$ (B) $-\frac{3x+1}{2-x}$ (C) $\frac{3x-1}{x-2}$ (D) $\frac{3x-1}{2-x}$ (E) $\frac{3x+1}{2-x}$

15. Solve the equation: $7e^{-4x} + 11 = 81$.

- (A) $x = \frac{\ln(10)}{4}$ (B) $x = -\frac{\ln(10)}{4}$ (C) $x = 2.5$ (D) $x = -2.5$ (E) $x = \frac{e^{-10}}{4}$

16. Solve the equation for q: $q^2 - 2q = a$.

- (A) $q = 1 \pm \sqrt{a+1}$ (B) $q = 1$ (C) $q = \pm a$ (D) $q = 1 \pm \sqrt{a}$ (E) $-1 \pm \sqrt{a+1}$

17. Solve the quadratic equation: $x^2 - 10x + 7 = 0$.

- (A) $x = 5 \pm 3\sqrt{2}$ (B) $x = 5 \pm \sqrt{34}$ (C) $x = 10 \pm 6\sqrt{2}$ (D) $x = -10 \pm 6\sqrt{2}$ (E) no solution

18. Solve the cubic equation: $x^3 - 3x^2 - x + 3 = 0$.

- (A) 3, 1, -1 (B) 1, $\sqrt{3}$, $-\sqrt{3}$ (C) -3, i , $-i$ (D) 3, i , $-i$ (E) -3, 1, -1

19. Solve the matrix equation for x: $\begin{bmatrix} 4 & 7 \\ 5 & 3 \end{bmatrix} \begin{bmatrix} x & -1 \\ 2 & 8 \end{bmatrix} = \begin{bmatrix} 38 & 52 \\ 36 & 19 \end{bmatrix}$

- (A) 9.5 (B) 6 (C) -9.5 (D) -6 (E) 9

20. Solve for t: $4t^5 - 11 = 200$.

- (A) $\frac{\sqrt[5]{211}}{4}$ (B) $\pm \frac{\sqrt[5]{211}}{4}$ (C) $\pm \frac{\sqrt[5]{189}}{4}$ (D) $\frac{\sqrt[5]{189}}{4}$ (E) $\sqrt[5]{\frac{211}{4}}$

21. Solve for y: $ax + by = c$.

- (A) $x = \frac{c - by}{a}$ (B) $y = c + ax$ (C) $y = \frac{c - ax}{b}$ (D) $y = \frac{c + ax}{b}$ (E) $y = c - ax$

22. Given that $x^3 - 8x + 21x - 20$ has a zero at $x = 4$, find the remaining two zeros.

- (A) $1 \pm i$ (B) $1 \pm 2i$ (C) $4 \pm i$ (D) $2 \pm i$ (E) $4 \pm 2i$

23. Solve the equation: $3x^{-2} = 4x^{-1}$

- (A) 4/3 (B) 3/4 (C) 4/3, 0 (D) 3/4, 0 (E) 0

24. Solve the equation: $(x + 2)^{-5/3} = 2$.

- (A) $-2 - \sqrt[5]{\frac{1}{8}}$ (B) $-2 + \sqrt[5]{\frac{1}{8}}$ (C) $2 + \sqrt[5]{\frac{1}{8}}$ (D) $2 - \sqrt[5]{\frac{1}{8}}$ (E) not given

25. Solve the equation for a: $(2a + 4) - (7a - 10) = 18$.

- (A) 4/5 (B) -4/5 (C) -24/5 (D) 24/5 (E) 32/5

26. Simplify: $\frac{5 + i}{4 - 3i}$

- (A) $\frac{17}{7} + \frac{19}{7}i$ (B) $\frac{17}{13} + \frac{19}{13}i$ (C) $\frac{17}{7} - \frac{19}{7}i$ (D) $\frac{17}{13} - \frac{19}{13}i$ (E) $\frac{17}{25} + \frac{19}{25}i$

27. Simplify: $i^{48}(25 - 3i)$

- (A) $25 - 3i$ (B) $-25 + 3i$ (C) $3 + 25i$ (D) $3 - 25i$ (E) not given

28. Simplify: $\frac{\frac{1}{x} - 4}{\frac{x}{2} - 3}$

- (A) $\frac{1-3x}{2-4x}$ (B) $\frac{1-4x}{2-3x}$ (C) $\frac{2+3x}{1-4x}$ (D) $\frac{1+4x}{2-3x}$ (E) not given

29. Solve and write your answer in interval notation: $|3x+2|-5 > 11$

- (A) $(-\infty, -6) \cup (\frac{14}{3}, \infty)$ (B) $(6, \infty)$ (C) $(-\infty, -\frac{14}{3}) \cup (6, \infty)$ (D) no solution (E) not given

30. Solve and write your answer in interval notation: $2x+3 > 7$ and $4x+1 < 101$

- (A) $(2, 25)$ (B) $(5, 25)$ (C) no solution (D) $(2, \infty)$ (E) $(5, \infty)$

31. Write the standard equation of the conic section: $25x^2 - 9y^2 + 100x + 36y - 161 = 0$

- (A) $\frac{(x+2)^2}{9} + \frac{(y-2)^2}{25} = 1$ (B) $\frac{(x+2)^2}{9} - \frac{(y-2)^2}{25} = 1$ (C) $\frac{(x+2)^2}{25} + \frac{(y-2)^2}{9} = 1$ (D) $\frac{(x+2)^2}{25} - \frac{(y-2)^2}{9} = 1$ (E) not given

32. Solve: $\begin{cases} x^2 + y^2 = 9 \\ x^2 - y^2 = 1 \end{cases}$

- (A) $(\sqrt{5}, 2)$ (B) $(\pm\sqrt{5}, \pm 2)$ (C) $(\pm 2, \pm\sqrt{5})$ (D) $(2, \sqrt{5})$ (E) not given

33. Evaluate: $\sum_{n=1}^{\infty} 23 \left(\frac{1}{2}\right)^{n-1}$

- (A) 46 (B) 23 (C) 23/2 (D) 23/4 (E) not given

34. If $f(x) = 4 - x^2$, evaluate $f(a+h)$.

- (A) $4 - a^2 + 2ah + h^2$ (B) $4 - a^2 - 2ah + h^2$ (C) $4 - a^2 - 2ah - h^2$ (D) $4 - a^2 - ah - h^2$ (E) not given

For questions 35 – 40, suppose $f(x) = 2x^2$, $g(x) = e^{x-2}$, $h(x) = \sqrt{x^3 + 1}$

35. Find $f(h(0))$.

- (A) 1 (B) no solution (C) $2e^{-4}$ (D) 2 (E) not given

36. Find $h(g(2))$.

- (A) 1 (B) $\sqrt[3]{2}$ (C) $\sqrt{2}$ (D) 2 (E) not given

37. Find $g^{-1}(x)$.

- (A) $2 + \ln x$ (B) $2 - \ln x$ (C) $\ln(x + 2)$ (D) $\ln(x - 2)$ (E) not given

38. Find $h^{-1}(x)$.

- (A) $\sqrt[3]{x^2 - 1}$ (B) $\sqrt[3]{1 - x^2}$ (C) $\sqrt[3]{1 + x^2}$ (D) $\pm\sqrt[3]{1 + x^2}$ (E) not given

39. Find $\frac{g(2)}{h(7)}$.

- (A) $\frac{1}{344}$ (B) $\frac{\sqrt{344}}{344}$ (C) $\frac{1}{50}$ (D) $\frac{e}{344}$ (E) $\sqrt{\frac{e}{344}}$

40. Find $h(f(-3))$.

- (A) $\sqrt{5833}$ (B) $\sqrt{325}$ (C) no solution (D) e^{16} (E) not given