KCATM 2011
Algebra: Team

1. $(x + y) + z = z + (x + y)$ is an example of the _____ property of addition.

A. commutative
B. associative
C. distributive
D. identity

2. The number 0.06022 expressed in scientific notation is

A. 6.022×10^{-2}
B. 0.6022×10^{-1}
C. 60.22×10^{-3}
D. 6022×10^{-5}

3. Given: a Δ b $= 2a^2 - 3b$, what is the value of $(3\Delta2)\Delta1$?
A. 12
B. 47
C. 285
D. none of the above

4. If the sum of five consecutive even integers is equal to their product, what is the greatest of the five integers?

A. 4
B. 10
C. 14
D. 16

5. $\dfrac{\sqrt{32} + \sqrt{24}}{\sqrt{8}}$ is equivalent to…

A. $\sqrt{7}$
B. $\sqrt{2} + \sqrt{3}$
C. $2 + \sqrt{3}$
D. $\sqrt{2} + 3$

6. The sum of all the integers from 1 to 44, inclusive, is subtracted from the sum of all the integers from 7 to 50, inclusive. What is the result?

A. 6
B. 44
C. 264
D. 300

7. Factor: $25x^6 - 121y^4$

A. $55(x^3 - y^2)(x^3 + y^2)$
B. $(5x^3 - 11y^2)(5x^3 + 11y^2)$
C. $(5x^3 - 11y^2)(5x^3 - 11y^2)$
D. $(5x^3 + 11y^2)(5x^3 + 11y^2)$

8. If $x^2 + 6x + 8 = 4 + 10x$, then $x = ?$

A. 2
B. -2
C. 1
D. -1

9. Solve for x: $\dfrac{5x+1}{2} + \dfrac{x-2}{3} = \dfrac{8x+8}{6}$

A. 1
B. 2
C. -1
D. -2

10. What is the slope of the line whose equation is $3x - 4y - 16 = 0$?

A. $\frac{3}{4}$
B. $\frac{4}{3}$
C. 3
D. -4

11. What is the slope of a line passing through the points (3,5) and (-2,6)?
A. $-\frac{1}{5}$
B. -1
C. -5
D. $\frac{11}{5}$

12. A horizontal line has a slope of…
A. 0
B. 1
C. -1
D. *undefined*

13. What are the coordinates of the y-intercept of the equation $y - 3x = 5$?
A. (0,3)
B. (0,5)
C. (0,–3)
D. (0,–5)

14. In the following system, what does $z = $?

$$x + 3y - z = -6$$
$$2x + 3y + 2z = 11$$
$$-3x + 4y - 2z = -20$$

A. -1
B. -2
C. 2
D. 5

15. Solve: $x^4 + x^3 + x^2 + x = 0$

A. -1, 0, 1, -.25
B. -1, 0
C. -1, 0, i, $-i$
D. $i, -i$

16. Simplify $|\pi - 7|$ without using absolute value symbols.

A. $7 - \pi$
B. $\pi - 7$
C. $\pi + 7$
D. $-\pi - 7$

17. How many real solutions does the following equation have $\sqrt{6x + 19} = x - 6$?

A. 4
B. 2
C. 1
D. 0

18. Solve: $2x^{\frac{1}{2}} + 3x^{\frac{1}{4}} - 2 = 0$
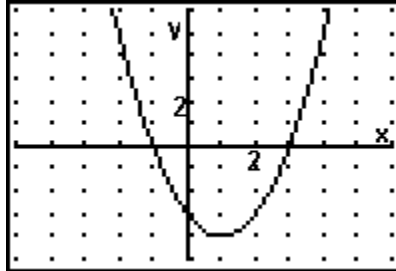
A. 16
B. 9
C. $\dfrac{1}{9}$
D. $\dfrac{1}{16}$

19. Solve: $x^2 + 12x \geq 45$

A. $(-\infty, 15] \cup [3, \infty)$
B. $(-\infty, 3] \cup [15, \infty)$
C. $(-\infty, -15] \cup [3, \infty)$
D. $[-15, 3]$

20. What is the equation of the axis of symmetry of the graph $y = 3x^2 + 12x - 2$?

A. $x = -2$
B. $x = 2$
C. $y = -2$
D. $y = 2$
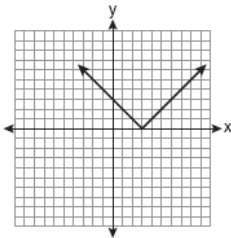
21. What are the roots of this parabola?
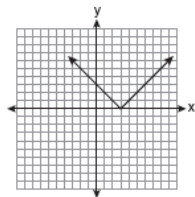

A. 3 and 1

B. 1 and 0

C. 3 and -1

D. -4 and 0

22. The diagram below shows the graph of $y = f(x)$.
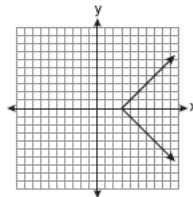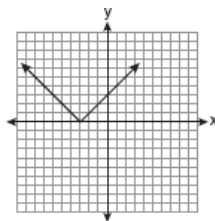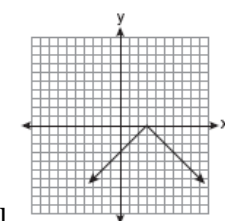   Which answer shows the graph of $y = -f(x)$?

[A]

[B]

[C]

[D]

23. Find the midpoint of the line segment with endpoints (2,-2) and (-3,-8).

A. (-.5,-5)
B. (-2.5,-5)
C. (-.5, 5)
D. (2.5,-5)

24. Determine the length of the line segment with endpoints (4,-3) and (-1, 10).

A. 10
B. $\sqrt{194}$
C. $\sqrt{206}$
D. $\sqrt{58}$

25. Find the center and radius of the circle given by: $x^2 - 4x + y^2 - 6y + 12 = 0$

A. $(2,3), r = \sqrt{12}$
B. $(-2,-3), r = 1$
C. $(2,3), r = 1$
D. $(4,6), r = 1$

26. Which one of the following defines y as a function of x?

A. $2x^2 - 3y = 5$
B. $|y| = 2x$
C. $y = \pm|x - 4| - 2$
D. $x = \sqrt{y^2 - 9}$

27. Find the difference quotient for: $f(x) = 2x^2 - 3x$

A. $4x - 3 + 2h$
B. $4x - 3$
C. $4x - 3 + h$
D. $4x + h$

28. Let $f(x) = 1 - x^2$ and $g(x) = 2x + 1$. Find $(f \circ g)(x)$.

A. $-2x^2 + 3$
B. $-4x^2 + 4x + 2$
C. $-4x^2 + 2$
D. $-4x^2 - 4x$

29. Determine the remainder when $2x^3 - 5x^2 + 5x - 7$ is divided by $x - 2$.

A. 2
B. -1
C. -11
D. -53

30. Which equation below could depict exponential decay?

A. $y = 3^x$
B. $y = 1.4^x$
C. $y = 0.5^x$
D. $y = 2^x$

31. If the square root of x is greater than x, then x could be

A. 0
B. 1/2
C. 2
D. 4

32. The expression $(4a + 2b) - (2a - 3b) - (a - b)$ when simplified is

A. $6a + 6b$
B. $a + 6b$
C. $-2b$
D. $6b$

33. Simplify: $\dfrac{2 - 3i}{5 + 7i}$

A. $\dfrac{2}{5} - \dfrac{3}{7}i$

B. $\dfrac{2}{35} - \dfrac{3}{35}i$

C. $-\dfrac{11}{74} - \dfrac{29}{74}i$

D. $\dfrac{11}{74} - \dfrac{29}{74}i$

34. What is the point of intersection of the lines $5x + 2y = 4$ and $x - 2y = 8$?

A. (2,3)
B. (-2,3)
C. (2,-3)
D. (-3,2)

35. Which is the equation of a line whose slope is undefined?

A. $x = -5$
B. $y = 7$
C. $x = y$
D. $x + y = 0$

36. Which of these equations represents a line parallel to the line $2x + y = 6$?

A. $y = 2x + 3$
B. $y - 2x = 4$
C. $2x - y = 8$
D. $y = -2x + 1$

37. Simplify: i^{641}

A. 1
B. i
C. -1
D. $-i$

38. Rationalize: $\dfrac{8}{\sqrt[4]{8}}$

A. $\dfrac{1}{8}$

B. $\sqrt[4]{8}$

C $\sqrt[4]{2}$

D. 1

39. Solve: $5x^2 + 11x = -1$

A. $\dfrac{-11 + \sqrt{141}}{10}$

B. $\dfrac{11 + \sqrt{101}}{10}$

C. $\dfrac{11 + \sqrt{141}}{10}$

D. $\dfrac{-11 + \sqrt{101}}{10}$

40. Factor: $6x^2 + 23x + 10$

A. $(3x + 2)(2x + 5)$
B. $(2x + 10)(3x + 1)$
C. $(2x + 2)(3x + 5)$
D. $(2x + 1)(3x + 10)$

41. Factor: $12ax + 15bx - 8ay - 10by$

A. $(4a + 5b)(3x - 2y)$
B. $(4a - 5b)(3x + 2y)$
C. $(4a + 2b)(3x - 5y)$
D. $(4a - 5b)(3x - 2y)$

42. Factor: $120a^3 - 480a$

A. $120a(a - 2)^2$
B. $(a + 2)(a - 2)$
C. $120a(a^2 - 2)$
D. $120a(a + 2)(a - 2)$

43. $f(x) = \dfrac{x^2}{x^3 + 1}$ is:

A. an even function
B. an odd function
C. a one-to-one function
D. None of the Above

44. Which one of the following polynomials has a real zero between $x = 1$ and $x = 2$?

A. $P(x) = 3x^3 - 2x^2 - 3x + 1$
B. $P(x) = 2x^3 - 5x^2 - 7x - 11$
C. $P(x) = 5x^4 + 2x^3 + 3x^2 - 2x - 4$
D. $P(x) = 5x^4 + 3x^2 + 2x - 9$

45. If P is a polynomial and a is a number for which $P(a) = 0$, then:

A. $(x + a)$ is a factor of P
B. $(x - a)$ is a factor of P
C. $(0, a)$ is an intercept of the graph P
D. $P(0) = a$

46. Find the slant asymptote of $F(x) = \dfrac{x^2 + 3x + 1}{x + 1}$.

A. $y = x + 1$
B. $y = 2x + 1$
C. $y = x - 1$
D. $y = x + 2$

47. Determine the equation of the horizontal asymptote of the graph

$$F(x) = \frac{x^4 - 6x^3 + 7x - 2}{x^4 - 4x^2 + 1}$$

A. $y = 1$
B. $y = 0$
C. $y = \frac{4}{3}$
D. $y = -2$

48. The population of a suburb, in thousands, is modeled by $P(t) = \dfrac{720t}{0.6t^2 + 15}$, where t is the time in years after the year 2000. In what year will the population of the suburb reach its maximum?

A. 2001
B. 2002
C. 2005
D. 2008

49. Given $\log_b 5 = 0.8271$ and $\log_b 3 = 0.5646$, evaluate $\log_b 45$.

A. 0.93396
B. 1.3917
C. 1.8965
D. 1.9563

50. Approximate $\log_3 19$ to four decimal places.

A. 2.5405
B. 2.7114
C. 2.6801
D. 2.6334

51. Solve $3^{2x+1} = \dfrac{1}{243}$.

A. $x = 2$
B. $x = 3$
C. $x = -2$
D. $x = -3$

52. Find the Vertex and Directrix of the parabola given by $x^2 - 4x - 8y - 20 = 0$.

A. $Vertex : (-3,2); Directrix : x = -5$
B. $Vertex : (4,-3); Directrix : y = 1$
C. $Vertex : (-2,3); Directrix : y = 5$
D. $Vertex : (2,-3); Directrix : y = -5$

53. Find the equation of the ellipse that has center (-1, 4), has foci at (-1, 8) and (-1, 0) and the length of whose minor axis is $\sqrt{3}$.

A. $\dfrac{x^2}{3} + \dfrac{y^2}{19} = 1$

B. $\dfrac{(x-1)^2}{19} + \dfrac{(y+4)^2}{3} = 1$

C. $\dfrac{(x-1)^2}{19} + \dfrac{(y-4)^2}{3} = 1$

D. $\dfrac{(x+1)^2}{3} + \dfrac{(y-4)^2}{19} = 1$

54. Find the eccentricity of the ellipse given by $25x^2 + 9y^2 = 225$.

A. $\dfrac{4}{5}$

B. $\dfrac{5}{4}$

C. $\dfrac{9}{16}$

D. $\dfrac{16}{25}$

55. Find the partial fraction decomposition of $\dfrac{14x+2}{(x-5)(x+7)}$

A. $\dfrac{6}{x-5} + \dfrac{8}{x+7}$

B. $\dfrac{8}{x-5} + \dfrac{6}{x+7}$

C. $\dfrac{6}{x-5} + \dfrac{-8}{x+7}$

D. $\dfrac{-6}{x-5} + \dfrac{8}{x+7}$

56. Given $A = \begin{bmatrix} 6 & -3 \\ 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & -3 \\ 9 & -7 \end{bmatrix}$ find A-$2B$.

A. $\begin{bmatrix} 10 & 3 \\ -14 & 15 \end{bmatrix}$

B. $\begin{bmatrix} 2 & -9 \\ 22 & -13 \end{bmatrix}$

C. $\begin{bmatrix} 8 & 0 \\ -5 & 8 \end{bmatrix}$

D. None of the Above

57. Find the product $\begin{bmatrix} 8 & -1 \\ 7 & -4 \\ -3 & 0 \end{bmatrix}\begin{bmatrix} 11 & 2 \\ 0 & -1 \end{bmatrix}$.

A. $\begin{bmatrix} 88 & 35 & -6 \\ 0 & -12 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 88 & -33 \\ 43 & -15 \\ 15 & -6 \end{bmatrix}$

C. $\begin{bmatrix} 88 & 17 \\ 77 & 18 \\ -33 & -6 \end{bmatrix}$

D. None of the Above

58. Find the twelfth term of $(2x-y)^{15}$ when expanded.

A. $-1863680x^{12}y^{3}$
B. $3640x^{3}y^{8}$
C. $-21840x^{4}y^{11}$
D. $2795520x^{11}y^{4}$

59. The sequence 4,6,9,13.5,…is:

A. an arithmetic sequence
B. a geometric sequence
C. the Fibonacci sequence
D. the binomial sequence

60. Find $\displaystyle\sum_{k=0}^{4}(-1)^{k+1}(3k-2)$.

A. 4
B. -8
C. -10
D. -4