1) If $A = \{x \mid x \leq -3\} \cup \{x \mid x > 1\}$ and
$B = \{x \mid 0 \leq x \leq 3\} \cap \{x \mid 1 < x < 4\}$, then $A \cap B =$

A) $(1, 3]$

B) $(-\infty, 0] \cup [3, 4)$

C) $(1, 4]$

D) $[3, \infty)$

E) $(-\infty, 3]$

2) The expression $\dfrac{-20 \div 4 \cdot 5 - 11}{32 \div 8 \cdot 2 - (5 - 3)}$ simplifies to

A) -6

B) 6

C) 5

D) -5

E) 3

3) $\dfrac{(0.9)(3\times10^{10})}{0.000009} =$

A) 3×10^{15}

B) 3×10^{14}

C) 3×10^{16}

D) 3×10^{10}

E) 9×10^{17}

4) If $x > 0$ and $y > 0$, then $2y^3\left(\dfrac{3x^3y^{-2}}{24x^{-6}y^4}\right)^{1/3}\left(\dfrac{(-9)^2y^8}{x^4}\right)^{1/4} =$

A) $3x^2y^3$

B) $\dfrac{3}{x^2y^3}$

C) $10x^2y^3$

D) $3x^3y^2$

E) $\dfrac{3x^3}{y^2}$

5) One factor of the polynomial $x^5 - 9x^3 - 8x^2 + 72$ is

A) $x^2 + 2x + 4$

B) $x^2 - 2x - 4$

C) $x^2 - 2x + 4$

D) $x + 2$

E) $x + 4$

6) The expression $\dfrac{3}{\sqrt[4]{\left(2 - \sqrt{7}\right)^4}}$ simplifies to

A) $2 + \sqrt{7}$

B) $-2 + \sqrt{7}$

C) $-2 - \sqrt{7}$

D) $2 - \sqrt{7}$

E) $2\sqrt{7}$

7) The expression $\left[1 - \dfrac{3x - 11}{x^2 - 9}\right] \div \dfrac{x - 2}{x^2 - 9}$ simplifies to

A) $x - 1$

B) $x + 3$

C) $x - 3$

D) $x - 2$

E) $x + 1$

8) The expression $\dfrac{x^{-4} - y^{-2}}{x^{-2}\, y^{-1}\, (x^{-2} - y^{-1})}$ simplifies to

A) $x^2 + y$

B) $x^2 + y^2$

C) $y - x^2$

D) $x - y^2$

E) $x^2 - y$

9) The equation of the circle, with endpoints $P(-1, 3)$ and $Q(7, -5)$ of a diameter, is

A) $x^2 + y^2 - 6x + 2y - 22 = 0$

B) $x^2 + y^2 + 2x - 6y + 22 = 0$

C) $x^2 + y^2 - 6x - 2y + 22 = 0$

D) $x^2 + y^2 + 6x - 2y + 19 = 0$

E) $x^2 + y^2 - 6x + 2y - 19 = 0$

10) If the line $x + 2y = 5$ is perpendicular to the line through the points $(k + 1, k^2 - 2)$ and $(-1, -3)$, then the sum of all possible values of k is

A) 2

B) -2

C) 1

D) - 3

E) 3

11) If $k > 0$, and the quadratic equation $kx^2 + 9x + k = 0$ has exactly one real solution, then $2k + 1 =$

A) 10

B) 5

C) 17

D) 3

E) 11

12) The sum of the real part and the imaginary part of the complex number $\frac{1}{1+i} - \frac{1}{1-i} + \sqrt{-3}\sqrt{-12}$, where $i = \sqrt{-1}$ is

A) - 7

B) - 6

C) - 1

D) 6

E) 5

13) The sum of all the solutions of the equation $\frac{2}{x^2 - 1} - \frac{1}{x - 1} = \frac{1}{2}$ is

A) -3

B) -1

C) 6

D) 2

E) 3

14) The solution set, in interval notation, of the inequality $x \geq \frac{3}{x + 2}$ is

A) $[-3, -2) \cup [1, \infty)$

B) $(-\infty, -3] \cup [1, \infty)$

C) $(-\infty, -2) \cup (-2, \infty)$

D) $[-3, 1)$

E) $(-\infty, -3] \cup (-2, 1]$

15) The solution set, in interval notation, of $\frac{1}{2}\left|4x + \frac{1}{3}\right| - \frac{5}{6} > 0$ is

A) $(-\infty, -\frac{1}{2}) \cup (\frac{1}{3}, \infty)$

B) $(-\infty, \frac{1}{3})$

C) $(-\infty, -\frac{1}{3}) \cup (\frac{1}{2}, \infty)$

D) $(-\frac{1}{3}, \frac{1}{2})$

E) $(-\frac{1}{2}, \frac{1}{3})$

16) If $f(x) = \begin{cases} -x^2 + 2x & \text{if } x < 0 \\ [\![2x + 1]\!] & \text{if } 0 \le x < 2 \\ |-x - 3| & \text{if } x \ge 2 \end{cases}$, where $[\![\ \ ]\!]$ denotes the greatest integer function , then $f(-2) + f(\frac{\pi}{2}) + f(3) =$

A) 2

B) 3

C) - 3

D) 4

E) - 5

17) Which one of the following statements is true about the graph below?

A) Decreasing on $(1, 3)$

B) Domain $[-5, 5]$

C) Range $[-5, 3]$

D) Constant on $[-5, 0]$

E) Increasing on $(-5, -1) \cup (1, 3)$

18) If $y = f(x)$ is a linear function with x-intercept $\frac{2}{3}$ and y-intercept -2, then $f(-2) =$

A) -8

B) 2

C) 8

D) -4

E) 4

19) Which one of the following statements is TRUE ?

A) $f(x) = \dfrac{x^5}{x^4 - 1}$ is an odd function

B) $f(x) = x^3 + x|x|$ is neither an odd nor an even function

C) $f(x) = |x - 2|$ is an even function

D) $f(x) = x^7 + x^5 + 1$ is an odd function

E) $f(x) = 1 + \sqrt[3]{x}$ is an even function

20) If the graph of the function $f(x) = \sqrt{x}$ is reflected across the x-axis, then shifted 3 units to the right and 4 units upward, then the equation $y = g(x)$ of the new graph is

A) $g(x) = -\sqrt{x - 3} + 4$

B) $g(x) = \sqrt{-x - 3} + 4$

C) $g(x) = -\sqrt{x + 3} - 4$

D) $g(x) = \sqrt{-x + 3} - 4$

E) $g(x) = -\sqrt{x - 4} + 3$

21) If $f(x) = 3x - 1$ and $(f \circ g)(x) = -3x^2 + 6x - 1$, then $g(-3) =$

A) -15

B) 15

C) -9

D) 9

E) 3

22) If $f(x) = \sqrt{16 - x^2}$ and $g(x) = x^2 - 6x$, then the domain of the function $\left(\frac{f}{g}\right)(x)$, in interval notation, is

A) $[-4, 0) \cup (0, 4]$

B) $(-\infty, -4] \cup [4, \infty)$

C) $[-4, 4]$

D) $[-4, 1) \cup (1, 4]$

E) $[-1, 4) \cup (4, \infty)$

23) The maximum value of the quadratic function $f(x) = -x^2 + x + 2$ is

A) $\frac{9}{4}$

B) $-\frac{9}{4}$

C) $\frac{1}{2}$

D) $-\frac{1}{2}$

E) $\frac{7}{4}$

24) The shortest distance between the line $y = -1$ and the vertex of the parabola $y = x^2 - 4x + 7$ is

A) 4

B) 6

C) 5

D) 2

E) 3

25) Which one of the following statements is TRUE about the graph of the polynomial function $f(x) = -2x^3(x+2)(x-3)^2$?

A) The graph lies above the x-axis on the interval $(-2, 0)$

B) The graph crosses the x-axis at one point only

C) The graph lies above the x-axis on the interval $(3, \infty)$

D) The graph has five x-intercepts

E) The graph crosses the x-axis at three points

26) If $Q(x)$ is the quotient and $R(x)$ is the remainder when $3x^4 - 5x^3 - 20x - 5$ is divided by $x^2 + x + 3$, then $Q(x) + R(x) =$

A) $3x^2 - 3x - 3$

B) $3x^2 + 3x + 3$

C) $3x^2 + 3x - 3$

D) $3x^2 + 3x - 9$

E) $3x^2 + 11x - 8$

27) If $f(x)$ is a polynomial function of degree 4 with integer coefficients having zeros -1, 1, $\sqrt{2}$, and constant term 6, then $f(x) =$

A) $3x^4 - 9x^2 + 6$

B) $2x^4 - 8x^2 + 6$

C) $-3x^4 - 3x^2 + 6$

D) $3x^4 + 9x^2 + 6$

E) $x^4 - 7x^2 + 6$

28) The number of rational zeros of the polynomial function $f(x) = 3x^4 + 2x^3 + 2x^2 + 2x - 1$ is

A) two

B) three

C) four

D) zero

E) one

29) A possible function for the graph below is

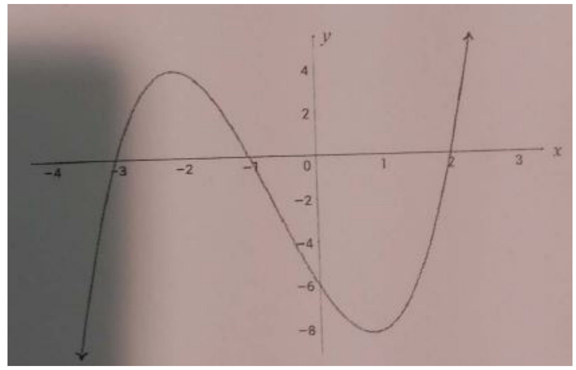
A) $f(x) = x^3 + 2x^2 - 5x - 6$

B) $f(x) = -x^3 - 2x^2 + 5x - 6$

C) $f(x) = x^3 - 9x^2 - x - 6$

D) $f(x) = 9x^2 + x - 6$

E) $f(x) = 2x^4 - 9x^3 + 9x^2 + x - 6$



30) If $f(x)$ is a fourth-degree polynomial with integer coefficients and zeros $3i$ and -1 with multiplicity 2, then a possible $f(x)$ is

A) $x^4 + 2x^3 + 10x^2 + 18x + 9$

B) $x^4 + 2x^3 + 5x^2 + 8x + 4$

C) $x^4 + 2x^3 + 2x^2 + 2x + 1$

D) $x^4 + 2x^3 + 6x^2 + 10x + 5$

E) $x^4 + 2x^3 - x^2 + x + 9$

31) If $2i$ is a zero of the polynomial $f(x) = 2x^4 - x^3 + 7x^2 - 4x - 4$,

then the product of all real zeros of $f(x)$ is equal to

A) $-\frac{1}{2}$

B) $\frac{1}{2}$

C) $\frac{3}{2}$

D) $-\frac{3}{2}$

E) -1

32) If the graph of the function $f(x) = \frac{ax - 3}{-2x + b}$ has a horizontal asymptote

$y = 3$ and a vertical asymptote $x = 4$, then $a + b =$

A) 2

B) 14

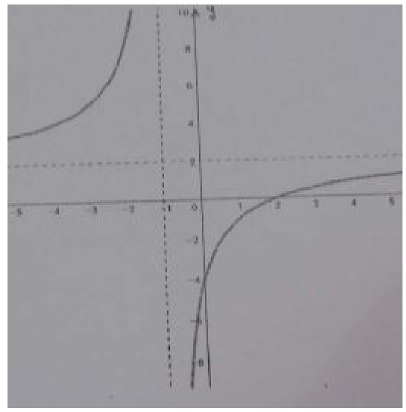
C) -14

D) 10

E) -2

33) If the equation of the graph below is given by $y = \dfrac{ax+b}{x+c}$, then

$a + b + c =$



A) -1

B) 2

C) -2

D) 1

E) 3

34) The domain, in interval notation, of the function $f(x) = \sqrt{-2 + |x-1|}$ is

A) $(-\infty, -1] \cup [3, \infty)$

B) $(-\infty, -3] \cup [1, \infty)$

C) $[-2, 2]$

D) $[-3, 1]$

E) $[-1, 3]$

35) If the graph of the quadratic function $f(x) = mx^2 - 12x - 1$ is increasing on $(-\infty, -2)$, then the RANGE of $f(x)$, in interval notation, is

A) $(-\infty, 11]$

B) $(-\infty, -1]$

C) $[11, \infty)$

D) $(-\infty, -13]$

E) $[13, \infty)$

36) If the point (1, 2) lies on the graph of $y = f(x)$, then which one of the following points lies on the graph of $y = -2f(x-2) + 3$

A) (3 , -1)

B) (-1 , 2)

C) (-1 , - ™)

D) (-1 , -1)

E) (2 , 0)