29

If x is the average (arithmetic mean) of m and 9, y is the average of $2m$ and 15, and z is the average of $3m$ and 18, what is the average of x, y, and z in terms of m ?

A) $m + 6$

B) $m + 7$

C) $2m + 14$

D) $3m + 21$

28

$$f(x) = (x + 6)(x - 4)$$

Which of the following is an equivalent form of the function f above in which the minimum value of f appears as a constant or coefficient?

A) $f(x) = x^2 - 24$

B) $f(x) = x^2 + 2x - 24$

C) $f(x) = (x - 1)^2 - 21$

D) $f(x) = (x + 1)^2 - 25$

25

$$f(x) = 2x^3 + 6x^2 + 4x$$
$$g(x) = x^2 + 3x + 2$$

The polynomials $f(x)$ and $g(x)$ are defined above. Which of the following polynomials is divisible by $2x + 3$?

A) $h(x) = f(x) + g(x)$

B) $p(x) = f(x) + 3g(x)$

C) $r(x) = 2f(x) + 3g(x)$

D) $s(x) = 3f(x) + 2g(x)$

26

Let x and y be numbers such that $-y < x < y$. Which of the following must be true?

    I. $|x| < y$

    II. $x > 0$

    III. $y > 0$

A) I only

B) I and II only

C) I and III only

D) I, II, and III

19

$$-3x + 4y = 20$$
$$6x + 3y = 15$$

If (x, y) is the solution to the system of equations above, what is the value of x ?

15

$$x^2 - \frac{k}{2}x = 2p$$

In the quadratic equation above, k and p are constants. What are the solutions for x ?

A) $x = \dfrac{k}{4} \pm \dfrac{\sqrt{k^2 + 2p}}{4}$

B) $x = \dfrac{k}{4} \pm \dfrac{\sqrt{k^2 + 32p}}{4}$

C) $x = \dfrac{k}{2} \pm \dfrac{\sqrt{k^2 + 2p}}{2}$

D) $x = \dfrac{k}{2} \pm \dfrac{\sqrt{k^2 + 32p}}{4}$

14

$$\frac{8 - i}{3 - 2i}$$

If the expression above is rewritten in the form $a + bi$, where a and b are real numbers, what is the value of a ? (Note: $i = \sqrt{-1}$)

A) 2

B) $\dfrac{8}{3}$

C) 3

D) $\dfrac{11}{3}$

11

$$x = 2y + 5$$

$$y = (2x - 3)(x + 9)$$

How many ordered pairs (x, y) satisfy the system of equations shown above?

A) 0

B) 1

C) 2

D) Infinitely many

30

$$3x + b = 5x - 7$$
$$3y + c = 5y - 7$$

In the equations above, b and c are constants.

If b is c minus $\frac{1}{2}$, which of the following is true?

A) x is y minus $\frac{1}{4}$.

B) x is y minus $\frac{1}{2}$.

C) x is y minus 1.

D) x is y plus $\frac{1}{2}$.

22

The sum of three numbers is 855. One of the numbers, x, is 50% more than the sum of the other two numbers. What is the value of x ?

A) 570

B) 513

C) 214

D) 155

14

What are the solutions to $3x^2 + 12x + 6 = 0$?

A) $x = -2 \pm \sqrt{2}$

B) $x = -2 \pm \dfrac{\sqrt{30}}{3}$

C) $x = -6 \pm \sqrt{2}$

D) $x = -6 \pm 6\sqrt{2}$

Questions 37 and 38 refer to the following information.

A botanist is cultivating a rare species of plant in a controlled environment and currently has 3000 of these plants. The population of this species that the botanist expects to grow next year, $N_{next\ year}$, can be estimated from the number of plants this year, $N_{this\ year}$, by the equation below.

$$N_{next\ year} = N_{this\ year} + 0.2\left(N_{this\ year}\right)\left(1 - \frac{N_{this\ year}}{K}\right)$$

The constant K in this formula is the number of plants the environment is able to support.

37

According to the formula, what will be the number of plants two years from now if $K = 4000$? (Round your answer to the nearest whole number.)

13

The equation $\dfrac{24x^2 + 25x - 47}{ax - 2} = -8x - 3 - \dfrac{53}{ax - 2}$ is

true for all values of $x \neq \dfrac{2}{a}$, where a is a constant.

What is the value of a ?

A) -16

B) -3

C) 3

D) 16

29

$$y = 3$$
$$y = ax^2 + b$$

In the system of equations above, a and b are constants. For which of the following values of a and b does the system of equations have exactly two real solutions?

A) $a = -2, b = 2$

B) $a = -2, b = 4$

C) $a = 2, b = 4$

D) $a = 4, b = 3$

24

$$x^2 + y^2 + 4x - 2y = -1$$

The equation of a circle in the xy-plane is shown above. What is the radius of the circle?

A) 2

B) 3

C) 4

D) 9

Questions 22 and 23 refer to the following information.

$$I = \frac{P}{4\pi r^2}$$

At a large distance r from a radio antenna, the intensity of the radio signal I is related to the power of the signal P by the formula above.

22

Which of the following expresses the square of the distance from the radio antenna in terms of the intensity of the radio signal and the power of the signal?

A) $r^2 = \dfrac{IP}{4\pi}$

B) $r^2 = \dfrac{P}{4\pi I}$

C) $r^2 = \dfrac{4\pi I}{P}$

D) $r^2 = \dfrac{I}{4\pi P}$

20

$$ax + by = 12$$
$$2x + 8y = 60$$

In the system of equations above, a and b are constants. If the system has infinitely many solutions, what is the value of $\dfrac{a}{b}$?

15

The expression $\dfrac{5x - 2}{x + 3}$ is equivalent to which of the following?

A) $\dfrac{5 - 2}{3}$

B) $5 - \dfrac{2}{3}$

C) $5 - \dfrac{2}{x + 3}$

D) $5 - \dfrac{17}{x + 3}$

12

$$R = \frac{F}{N+F}$$

A website uses the formula above to calculate a seller's rating, R, based on the number of favorable reviews, F, and unfavorable reviews, N. Which of the following expresses the number of favorable reviews in terms of the other variables?

A) $F = \dfrac{RN}{R-1}$

B) $F = \dfrac{RN}{1-R}$

C) $F = \dfrac{N}{1-R}$

D) $F = \dfrac{N}{R-1}$

13

What is the sum of all values of m that satisfy
$2m^2 - 16m + 8 = 0$?

A) -8

B) $-4\sqrt{3}$

C) $4\sqrt{3}$

D) 8

11

Which of the following complex numbers is

equivalent to $\dfrac{3-5i}{8+2i}$? (Note: $i = \sqrt{-1}$)

A) $\dfrac{3}{8} - \dfrac{5i}{2}$

B) $\dfrac{3}{8} + \dfrac{5i}{2}$

C) $\dfrac{7}{34} - \dfrac{23i}{34}$

D) $\dfrac{7}{34} + \dfrac{23i}{34}$

14

If $3x - y = 12$, what is the value of $\dfrac{8^x}{2^y}$?

A) 2^{12}

B) 4^4

C) 8^2

D) The value cannot be determined from the information given.

13

If $x > 3$, which of the following is equivalent

to $\dfrac{1}{\dfrac{1}{x+2} + \dfrac{1}{x+3}}$?

A) $\dfrac{2x+5}{x^2+5x+6}$

B) $\dfrac{x^2+5x+6}{2x+5}$

C) $2x+5$

D) x^2+5x+6

25

$$h = -4.9t^2 + 25t$$

The equation above expresses the approximate height h, in meters, of a ball t seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per second. After approximately how many seconds will the ball hit the ground?

A) 3.5

B) 4.0

C) 4.5

D) 5.0

15

If $(ax + 2)(bx + 7) = 15x^2 + cx + 14$ for all values of x, and $a + b = 8$, what are the two possible values for c ?

A) 3 and 5
B) 6 and 35
C) 10 and 21
D) 31 and 41

20

If $a = 5\sqrt{2}$ and $2a = \sqrt{2x}$, what is the value of x ?