Systems of Equations in Two Variables

CollegeBoard Question Bank

Abstract

This exercise sheet contains

- an **Easy** category with 19 questions;
- a **Medium** category with 33 questions;
- a **Hard** category with 25 questions

for you to attempt. A digital copy of this sheet is available for you on moodle. Feel free to utilize the **Question Space** on Teams to ask for guidance.

Best,
Omar :)

Systems of Equations in Two Variables

Easy

(1) **3c95093c** MULTIPLE CHOICE One answer only

$$6x - 9y > 12$$

Which of the following inequalities is equivalent to the inequality above?

a. $3x - 2y > 4$
b. $2x - 3y > 4$
c. $3y - 2x > 2$
d. $x - y > 2$

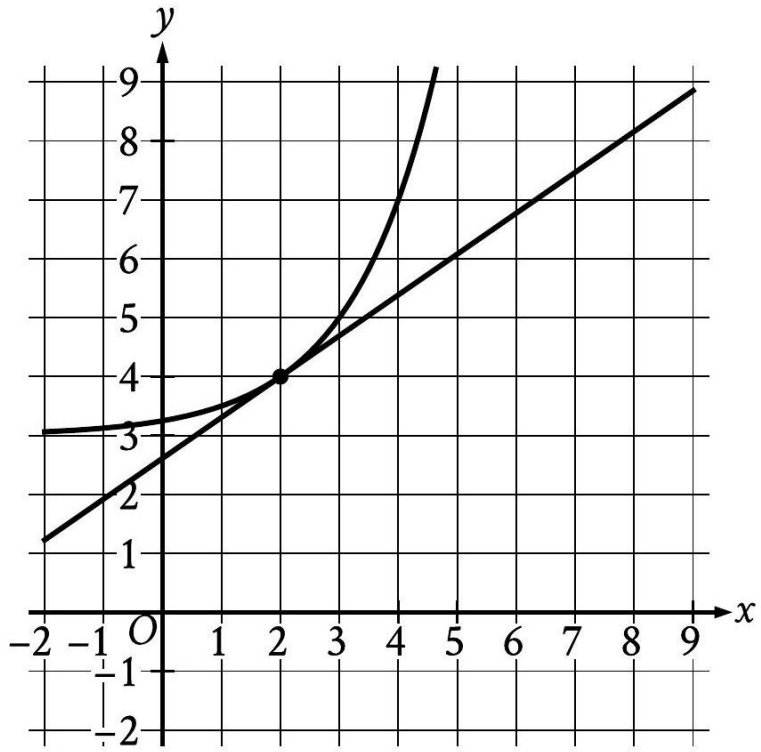
(2) **c6a26e14** MULTIPLE CHOICE One answer only

$$|x + 45| = 48$$

What is the positive solution to the given equation?

a. 93
b. 3
c. 96
d. 48

(3) **4ca30186** MULTIPLE CHOICE One answer only



The graph of a system of a linear equation and a nonlinear equation is shown. What is the solution (x, y) to this system?

a. $(2, 4)$
b. $(0, 0)$
c. $(0, 2)$
d. $(4, 0)$

(4) **3de7a7d7** MULTIPLE CHOICE One answer only

Which of the following is a solution to the equation $2x^2 - 4 = x^2$?

a. 3
b. 4
c. 1
d. 2

(5) **88867d37** MULTIPLE CHOICE One answer only

$$(x+2)(x-5)(x+9)=0$$

What is a positive solution to the given equation?

a. 5
b. 3
c. 4
d. 18

(6) **Obebc08c** [Multiple choice] [One answer only]

$$x = 3$$

$$y = (15 - x)^2$$

A solution to the given system of equations is (x, y). What is the value of xy ?

a. 18
b. 45
c. 432
d. 54

(7) **c1964c11** MULTIPLE CHOICE One answer only

$$p + 34 = q + r$$

The given equation relates the variables p, q, and r. Which equation correctly expresses p in terms of q and r ?

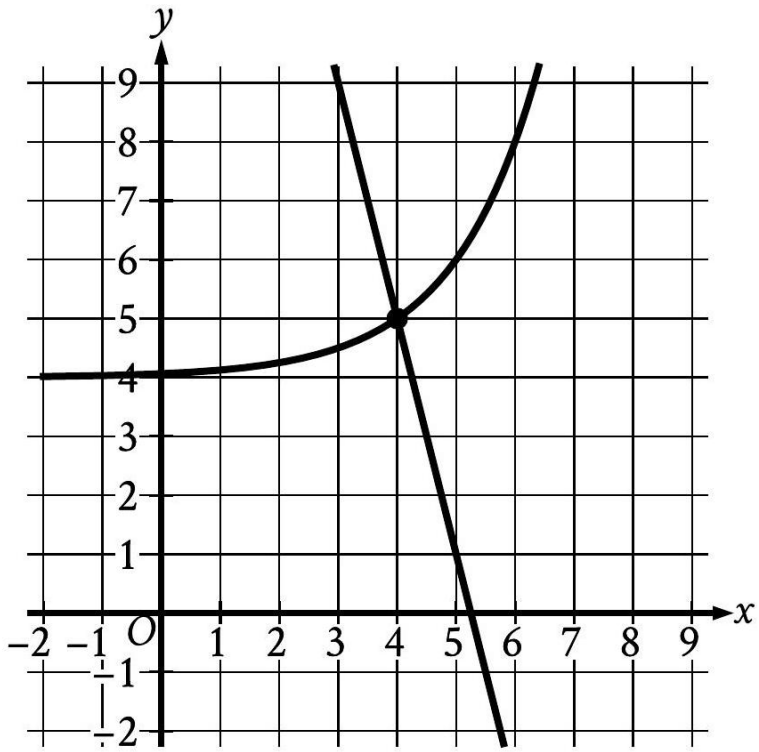
a. $p = -q - r - 34$
b. $p = -q - r + 34$
c. $p = q + r - 34$
d. $p = q + r + 34$

(8) **5639dd1a** SHORT ANSWER Case-Insensitive

$$x^2 = (22)(22)$$

What is the positive solution to the given equation?

(9) **3f8d5876** MULTIPLE CHOICE One answer only



The graph of a system of a linear equation and a nonlinear equation is shown. What is the solution (x, y) to this system?

a. $(0, 4)$
b. $(4, 5)$
c. $(0, 0)$
d. $(5, 0)$

(10) **568aaf27** MULTIPLE CHOICE One answer only

$$x + y = 12$$

$$y = x^2$$

If (x, y) is a solution to the system of equations above, which of the following is a possible value of x ?

a. 3
b. 2
c. 0
d. 1

(11) **7399c3b0** MULTIPLE CHOICE One answer only

$$k^2 - 53 = 91$$

What is the positive solution to the given equation?

a. 144
b. 12
c. 38
d. 72

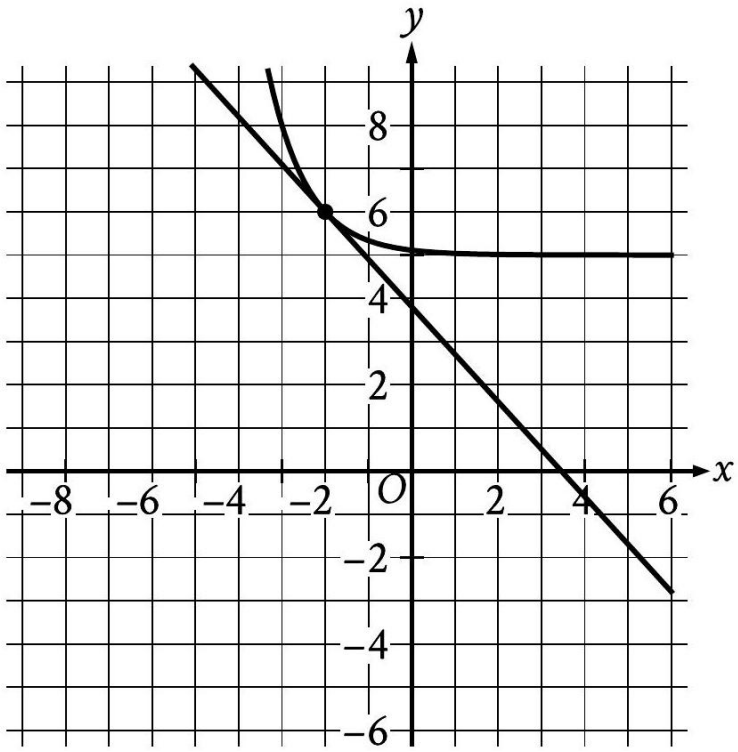
(12) **b76a2815** MULTIPLE CHOICE One answer only

$$P = \frac{W}{t}$$

The power P produced by a machine is represented by the equation above, where W is the work performed during an amount of time t. Which of the following correctly expresses W in terms of P and t?

a. $W = Pt$
b. $W = \frac{t}{P}$
c. $W = \frac{P}{t}$
d. $W = P + t$

(13) **5c7d5744** MULTIPLE CHOICE One answer only



The graph of a system of a linear equation and a nonlinear equation is shown. What is the solution (x, y) to this system?

a. $(-2, 6)$
b. $(6, 0)$
c. $(0, -2)$
d. $(0, 0)$

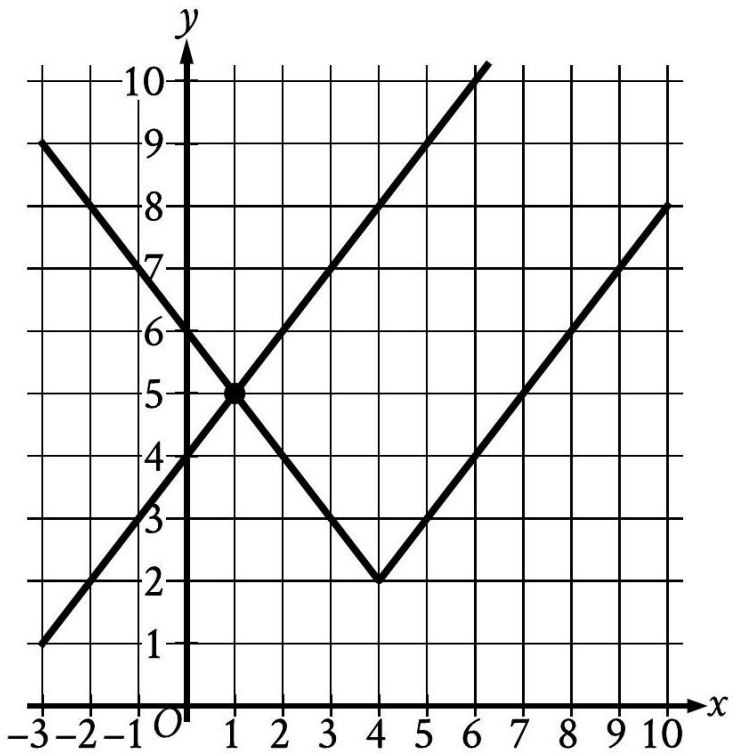
(14) **eb268057** MULTIPLE CHOICE One answer only

$$x^2 = 64$$

Which of the following values of x satisfies the given equation?

a. 128
b. -8
c. 4
d. 32

(15) **dd3a910a** MULTIPLE CHOICE One answer only



The graph of a system of an absolute value function and a linear function is shown. What is the solution (x, y) to this system of two equations?

a. $(0, 4)$
b. $(1, 5)$
c. $(4, 2)$
d. $(-1, 5)$

(16) **98f735f2** MULTIPLE CHOICE One answer only

The total revenue from sales of a product can be calculated using the formula $T = PQ$, where T is the total revenue, P is the price of the product, and Q is the quantity of the product sold. Which of the following equations gives the quantity of product sold in terms of P and T ?

a. $Q = \frac{P}{T}$
b. $Q = T - P$
c. $Q = \frac{T}{P}$
d. $Q = PT$

(17) **bf704c34** MULTIPLE CHOICE One answer only

$$c - 7 = 25p + k$$

The given equation relates the positive numbers c, p, and k. Which equation correctly expresses c in terms of p and k ?

a. $c = 25p + k - 7$
b. $c = 25p + k + 7$
c. $c = \frac{25p+k}{7}$
d. $c = 7(25p + k)$

(18) **4236c5a3** MULTIPLE CHOICE One answer only

If $(x+5)^2 = 4$, which of the following is a possible value of x ?

a. -3
b. -1
c. -2
d. 1

(19) **f11ffa93** SHORT ANSWER Case-Insensitive

$$\sqrt{x+4} = 11$$

What value of x satisfies the equation above?

Medium

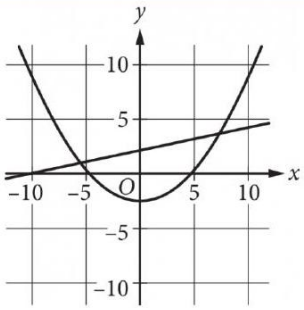
(1) **4e18fc5d** MULTIPLE CHOICE One answer only

$$v = -\frac{w}{150x}$$

The given equation relates the distinct positive numbers v, w, and x. Which equation correctly expresses w in terms of v and x ?

a. $w = v + 150x$
b. $w = -150vx$
c. $w = -\frac{x}{150v}$
d. $w = -\frac{150v}{x}$

(2) **a5663025** MULTIPLE CHOICE One answer only



A system of equations consists of a quadratic equation and a linear equation. The equations in this system are graphed in the xy-plane above. How many solutions does this system have?

a. 1
b. 2
c. 0
d. 3

(3) **d0a7871e** MULTIPLE CHOICE One answer only

$$y = x + 1$$

$$y = x^2 + x$$

If (x, y) is a solution to the system of equations above, which of the following could be the value of x ?

a. 0
b. 2
c. 3
d. -1

(4) **7f81d0c3** MULTIPLE CHOICE One answer only

$$x^2 - x - 1 = 0$$

What values satisfy the equation above?

a. $x = 1$ and $x = 2$
b. $x = \frac{1+\sqrt{5}}{2}$ and $x = \frac{1-\sqrt{5}}{2}$
c. $x = -\frac{1}{2}$ and $x = \frac{3}{2}$
d. $x = \frac{-1+\sqrt{5}}{2}$ and $x = \frac{-1-\sqrt{5}}{2}$

(5) **b4acba95** MULTIPLE CHOICE One answer only

$$x^2 - 12x + 27 = 0$$

How many distinct real solutions does the given equation have?

a. Zero
b. Exactly one
c. Exactly two
d. Infinitely many

(6) **6bdcac03** MULTIPLE CHOICE One answer only

$$x^2 = -841$$

How many distinct real solutions does the given equation have?

a. Zero
b. Infinitely many
c. Exactly two
d. Exactly one

(7) **3d7d7534** [Short answer] [Case-Insensitive]

$$(d - 30)(d + 30) - 7 = -7$$

What is a solution to the given equation?

(8) **911383f2** MULTIPLE CHOICE One answer only

$$(x-4)(x+2)(x-1)=0$$

What is the product of the solutions to the given equation?

a. 8
b. 3
c. -3
d. -8

(9) **b80d10d7** MULTIPLE CHOICE One answer only

$$\frac{2(x+1)}{x+5} = 1 - \frac{1}{x+5}$$

What is the solution to the equation above?

a. 2
b. 3
c. 5
d. 0

(10) **fcdf87b7** SHORT ANSWER Case-Insensitive

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

$$y = 4 - x$$

If the ordered pair (x, y) satisfies the system of equations above, what is one possible value of x ?

(11) **3148fe3e** MULTIPLE CHOICE One answer only

$$x^2 + y + 10 = 10$$

$$8x + 16 - y = 0$$

The solution to the given system of equations is (x, y). What is the value of x ?

a. -16
b. 8
c. -4
d. 2

(12) **652054da** MULTIPLE CHOICE One answer only

An oceanographer uses the equation $s = \frac{3}{2}p$ to model the speed s, in knots, of an ocean wave, where p represents the period of the wave, in seconds. Which of the following represents the period of the wave in terms of the speed of the wave?

a. $p = \frac{2}{3}s$
b. $p = \frac{3}{2}s$
c. $p = \frac{3}{2} + s$
d. $p = \frac{2}{3} + s$

(13) **0380bbdc** MULTIPLE CHOICE One answer only

If $4\sqrt{2x} = 16$, what is the value of $6x$?

a. 72
b. 48
c. 24
d. 96

(14) **6e02cd78** SHORT ANSWER Case-Insensitive

In the xy-plane, what is the y-coordinate of the point of intersection of the graphs of $y = (x-1)^2$ and $y = 2x - 3$?

(15) **802549ac** MULTIPLE CHOICE One answer only

$$(x+2)(x+3) = (x-2)(x-3) + 10$$

Which of the following is a solution to the given equation?

a. 0
b. -5
c. 1
d. -2

(16) **a4f61d75** SHORT ANSWER Case-Insensitive

$$x^2 - ax + 12 = 0$$

In the equation above, a is a constant and $a > 0$. If the equation has two integer solutions, what is a possible value of a ?

(17) **a267bd29** MULTIPLE CHOICE One answer only

$$w^2 + 12w - 40 = 0$$

Which of the following is a solution to the given equation?

a. $\sqrt{19}$
b. $2\sqrt{19}$
c. $6 - 2\sqrt{19}$
d. $-6 + 2\sqrt{19}$

(18) **630897df** MULTIPLE CHOICE One answer only

The speed of sound in dry air, v, can be modeled by the formula $v = 331.3 + 0.606T$, where T is the temperature in degrees Celsius and v is measured in meters per second. Which of the following correctly expresses T in terms of v ?

a. $T = \frac{v-331.3}{0.606}$
b. $T = \frac{v-0.606}{331.3}$
c. $T = \frac{v+0.606}{331.3}$
d. $T = \frac{v+331.3}{0.606}$

(19) **c77ef2fb** MULTIPLE CHOICE One answer only

Blood volume, V_B, in a human can be determined using the equation $V_B = \frac{V_P}{1-H}$, where V_P is the plasma volume and H is the hematocrit (the fraction of blood volume that is red blood cells). Which of the following correctly expresses the hematocrit in terms of the blood volume and the plasma volume?

a. $H = V_B - V_P$
b. $H = \frac{V_B}{V_P}$
c. $H = 1 + \frac{V_B}{V_P}$
d. $H = 1 - \frac{V_P}{V_B}$

(20) **364a2d25** SHORT ANSWER Case-Insensitive

$$x + y = 17$$

$$xy = 72$$

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

(21) **0980fcdd** MULTIPLE CHOICE One answer only

$$x^2 = 6x + y$$
$$y = -6x + 36$$

A solution to the given system of equations is (x, y). Which of the following is a possible value of xy ?

a. 36
b. 12
c. 6
d. 0

(22) **87a3de81** SHORT ANSWER Case-Insensitive

$$x^2 + x - 12 = 0$$

If a is a solution of the equation above and $a > 0$, what is the value of a ?

(23) **2683b5db** MULTIPLE CHOICE One answer only

$$T = 0.01(P - 40,000)$$

In a city, the property tax T, in dollars, is calculated using the formula above, where P is the value of the property, in dollars. Which of the following expresses the value of the property in terms of the property tax?

a. $P = 100T - 40,000$
b. $P = 100T + 40,000$
c. $P = 100T - 400$
d. $P = 100T + 400$

(24) **40f2e601** MULTIPLE CHOICE One answer only

$$P = N(19 - C)$$

The given equation relates the positive numbers P, N, and C. Which equation correctly expresses C in terms of P and N ?

a. $C = 19 + \frac{P}{N}$
b. $C = \frac{19+P}{N}$
c. $C = \frac{19-P}{N}$
d. $C = 19 - \frac{P}{N}$

(25) **2f958af9** MULTIPLE CHOICE One answer only

The formula above expresses the square of the speed v of a wave moving along $v^2 = \frac{LT}{m}$ a string in terms of tension T, mass m, and length L of the string. What is T in

a. $T = \frac{mv^2}{L}$
b. $T = \frac{L}{mv^2}$
c. $T = \frac{mL}{v^2}$
d. $T = \frac{m}{v^2L}$

(26) **876a731c** MULTIPLE CHOICE One answer only

$$\begin{aligned} y &= x^2 \\ 2y + 6 &= 2(x + 3) \end{aligned}$$

If (x, y) is a solution of the system of equations above and $x > 0$, what is the value of xy ?

a. 2
b. 3
c. 9
d. 1

(27) **928498f3** MULTIPLE CHOICE One answer only

$$6x^2 + 5x - 7 = 0$$

What are the solutions to the given equation?

a. $\frac{-5 \pm \sqrt{25+168}}{12}$
b. $\frac{-5 \pm \sqrt{36-168}}{12}$
c. $\frac{-6 \pm \sqrt{36-168}}{12}$
d. $\frac{-6 \pm \sqrt{25+168}}{12}$

(28) **f76c1858** SHORT ANSWER Case-Insensitive

$$7x^2 - 20x - 32 = 0$$

What is the positive solution to the given equation?

(29) **30a07668** SHORT ANSWER Case-Insensitive

$$y = 4x$$

$$y = x^2 - 12$$

A solution to the given system of equations is (x, y), where $x > 0$. What is the value of x ?

(30) **2d2ab76b** MULTIPLE CHOICE One answer only

$$y = x^2 - 1$$

$$y = 3$$

When the equations above are graphed in the xy-plane, what are the coordinates (x, y) of the points of intersection of the two graphs?

a. $(\sqrt{2}, 3)$ and $(-\sqrt{2}, 3)$
b. $(2, 4)$ and $(-2, 4)$
c. $(3, 8)$ and $(-3, 8)$
d. $(2, 3)$ and $(-2, 3)$

(31) **3b4b8831** [Short answer] [Case-Insensitive]

$$38x^2 = 38(9)$$

What is the negative solution to the given equation?

(32) **f5247e52** MULTIPLE CHOICE One answer only

$$y = ax^2 - c$$

In the equation above, a and c are positive constants. How many times does the graph of the equation above intersect the graph of the equation $y = a + c$ in the xy-plane?

a. More than two
b. Zero
c. One
d. Two

(33) **be1b8c74** MULTIPLE CHOICE One answer only

$$x = 8a(b + 9)$$

The given equation relates the positive numbers a, b, and x. Which equation correctly expresses a in terms of b and x ?

a. $a = \frac{x}{8} - (b + 9)$
b. $a = \frac{8(b+9)}{x}$
c. $a = \frac{x}{8(b+9)}$
d. $a = 8x(b + 9)$

Hard

(1) **fc3d783a** SHORT ANSWER Case-Insensitive

In the xy-plane, a line with equation $2y = 4.5$ intersects a parabola at exactly one point. If the parabola has equation $y = -4x^2 + bx$, where b is a positive constant, what is the value of b ?

(2) **4661e2a9** MULTIPLE CHOICE One answer only

$$x - y = 1$$

$$x + y = x^2 - 3$$

Which ordered pair is a solution to the system of equations above?

a. $(\sqrt{3}, -\sqrt{3})$
b. $(\sqrt{5}, -1 + \sqrt{5})$
c. $(1 + \sqrt{5}, \sqrt{5})$
d. $(1 + \sqrt{3}, \sqrt{3})$

(3) **f65288e8** MULTIPLE CHOICE One answer only

$$\frac{1}{x^2 + 10x + 25} = 4$$

If x is a solution to the given equation, which of the following is a possible value of $x + 5$?

a. $\frac{11}{2}$
b. $\frac{5}{2}$
c. $\frac{9}{2}$
d. $\frac{1}{2}$

(4) **2c288148** SHORT ANSWER Case-Insensitive

$$\sqrt{k-x} = 58 - x$$

In the given equation, k is a constant. The equation has exactly one real solution. What is the minimum possible value of $4k$?

(5) **f2f3fa00** SHORT ANSWER Case-Insensitive

During a 5-second time interval, the average acceleration a, in meters per second squared, of an object with an initial velocity of 12 meters per second is defined by the equation $a = \frac{v_f - 12}{5}$, where v_f is the final velocity of the object in meters per second. If the equation is rewritten in the form $v_f = xa + y$, where x and y are constants, what is the value of x ?

(6) **6ce95fc8** MULTIPLE CHOICE One answer only

$$2x^2 - 2 = 2x + 3$$

Which of the following is a solution to the equation above?

a. $1 - \sqrt{11}$
b. 2
c. $\frac{1}{2} + \sqrt{11}$
d. $\frac{1+\sqrt{11}}{2}$

(7) **74473be4** MULTIPLE CHOICE One answer only

Which quadratic equation has no real solutions?

a. $5x^2 - 14x - 49 = 0$
b. $x^2 - 14x + 49 = 0$
c. $x^2 + 14x - 49 = 0$
d. $5x^2 - 14x + 49 = 0$

(8) **7bd10ef3** MULTIPLE CHOICE One answer only

$$2x^2 - 4x = t$$

In the equation above, t is a constant. If the equation has no real solutions, which of the following could be the value of t ?

a. -3
b. -1
c. 3
d. 1

(9) **e11294f9** SHORT ANSWER Case-Insensitive

The solutions to $x^2 + 6x + 7 = 0$ are r and s, where $r < s$. The solutions to $x^2 + 8x + 8 = 0$ are t and u, where $t < u$. The solutions to $x^2 + 14x + c = 0$, where c is a constant, are $r + t$ and $s + u$. What is the value of c ?

(10) **7028c74f** SHORT ANSWER Case-Insensitive

$$5(x+7) = 15(x-17)(x+7)$$

What is the sum of the solutions to the given equation?

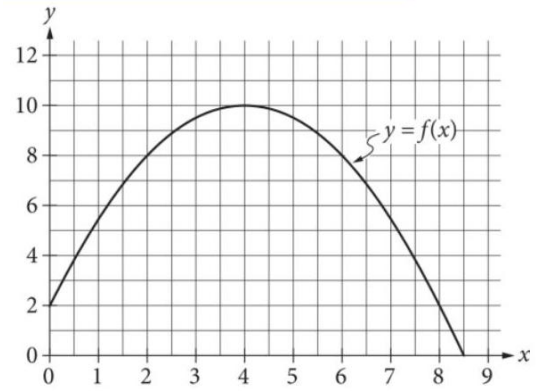
(11) **66bceOc1** MULTIPLE CHOICE One answer only

$$\sqrt{2x + 6 + 4} = x + 3$$

What is the solution set of the equation above?

a. $\{5\}$
b. $\{-1\}$
c. $\{-1, 5\}$
d. $\{0, -1, 5\}$

(12) **97e50fa2** SHORT ANSWER Case-Insensitive



The graph of the function f, defined by $f(x) = -\frac{1}{2}(x-4)^2 + 10$, is shown in the xy-plane above. If the function g (not shown) is defined by $g(x) = -x+10$, what is one possible value of a such that $f(a) = g(a)$?

(13) **3d12b1e0** SHORT ANSWER Case-Insensitive

$$-16x^2 - 8x + c = 0$$

In the given equation, c is a constant. The equation has exactly one solution. What is the value of c ?

(14) **71014fb1** MULTIPLE CHOICE One answer only

$$(x-1)^2 = -4$$

How many distinct real solutions does the given equation have?

a. Exactly one
b. Exactly two
c. Zero
d. Infinitely many

(15) **4dc5c6f9** MULTIPLE CHOICE One answer only

$$y = 18$$

$$y = -3(x - 18)^2 + 15$$

If the given equations are graphed in the xy-plane, at how many points do the graphs of the equations intersect?

a. Zero
b. Infinitely many
c. Exactly two
d. Exactly one

(16) **e9349667** MULTIPLE CHOICE One answer only

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

$$x + y + 1 = 0$$

If (x_1, y_1) and (x_2, y_2) are the two solutions to the system of equations above, what is the value of $y_1 + y_2$?

a. 1
b. -2
c. -3
d. -1

(17) **b03adde3** MULTIPLE CHOICE One answer only

If $u - 3 = \frac{6}{t-2}$, what is t in terms of u ?

a. $t = \frac{1}{u}$
b. $t = \frac{1}{u-3}$
c. $t = \frac{2u}{u-3}$
d. $t = \frac{2u+9}{u}$

(18) **c9417793** SHORT ANSWER Case-Insensitive

$$|x - 9| + 45 = 63$$

What is the sum of the solutions to the given equation?

(19) **30281058** MULTIPLE CHOICE One answer only

In the xy-plane, the graph of $y = x^2 - 9$ intersects line p at $(1, a)$ and $(5, b)$, where a and b are constants. What is the slope of line p ?

a. -6
b. 6
c. 2
d. -2

(20) **4fb8a648** MULTIPLE CHOICE One answer only

$$y = x + 9$$

$$y = x^2 + 16x + 63$$

A solution to the given system of equations is (x, y). What is the greatest possible value of x ?

a. 9
b. 7
c. -6
d. 63

(21) **5910bfff** MULTIPLE CHOICE One answer only

The formula above can be used to approximate the dew point D, in degrees Fahrenheit, given the temperature T, in degrees Fahrenheit, and the relative $D = T - \frac{9}{25}(100 - H)$ humidity of H percent, where $H > 50$. Which of the following expresses the relative humidity in terms of the temperature and the dew point?

a. $H = \frac{25}{9}(D - T) + 100$
b. $H = \frac{25}{9}(D - T) - 100$
c. $H = \frac{25}{9}(D + T) + 100$
d. $H = \frac{25}{9}(D + T) - 100$

(22) **1697ffcf** SHORT ANSWER Case-Insensitive

In the xy-plane, the graph of $y = 3x^2 - 14x$ intersects the graph of $y = x$ at the points $(0, 0)$ and (a, a). What is the value of a ?

(23) **2c5c22d0** MULTIPLE CHOICE One answer only

$$y = x^2 + 3x - 7$$

$$y - 5x + 8 = 0$$

How many solutions are there to the system of equations above?

a. There are exactly 2 solutions.
b. There is exactly 1 solution.
c. There are no solutions.
d. There are exactly 4 solutions.

(24) **fc3dfa26** MULTIPLE CHOICE One answer only

$$\frac{4x^2}{x^2-9} - \frac{2x}{x+3} = \frac{1}{x-3}$$

What value of x satisfies the equation above?

a. 3
b. $\frac{1}{2}$
c. $-\frac{1}{2}$
d. -3

(25) **58b109d4** [Short answer] [Case-Insensitive]

$$x^2 + y + 7 = 7$$

$$20x + 100 - y = 0$$

The solution to the given system of equations is (x, y). What is the value of x ?

Total of marks: 77