

Elementary Algebra

Final Exam

SAMPLE Final Exam

You will have 2 hours to complete this exam. You may use a calculator but must show all algebraic work in the space provided to receive full credit. Read all directions carefully, simplify all answers fully, and clearly indicate your answer. Good Luck!

NAME: _____

Spring 2018

KEY

Solve each equation. Show all algebraic work for full credit. (3 points each)

1) $9 - x = 2$

$$\begin{array}{r} -9 \quad -9 \\ 9 - x = 2 \end{array}$$

$$-x = -7$$

$$x = 7$$

1) $x = 7$

2) $2 = \frac{3}{4}x - 7$

$$\begin{array}{r} +7 \quad +7 \\ 2 = \frac{3}{4}x - 7 \end{array}$$

$$\left(\frac{4}{3}\right) \frac{9}{1} \left(\frac{4}{3}\right) \frac{3}{4} x$$

$$12 = x$$

2) $x = 12$

3) $3 + 7x = 6 - 2x$

$$\begin{array}{r} +2x \quad +2x \\ 3 + 7x = 6 - 2x \end{array}$$

$$\begin{array}{r} 3 + 9x = 6 \\ -3 \quad -3 \end{array}$$

$$\frac{9x}{9} = \frac{3}{9}$$

$$x = \frac{1}{3}$$

3) $x = \frac{1}{3}$

Solve each equation. Show all algebraic work for full credit. (3 points each)

4) $6(2x + 3) = 18$

$$\begin{array}{r} 12x + 18 = 18 \\ -18 \quad -18 \end{array}$$

$$12x = 0$$

$$x = 0$$

4) $x = 0$

5) $\frac{1}{2}x + \frac{3}{10} = \frac{4}{5}$

LCD = 10

$$\frac{10}{1}\left(\frac{1}{2}x\right) + \frac{10}{1}\left(\frac{3}{10}\right) = \frac{10}{1}\left(\frac{4}{5}\right)$$

$$\begin{array}{r} 5x + 3 = 8 \\ -3 \quad -3 \end{array}$$

$$\begin{array}{r} 5x = 5 \\ \hline 5 \quad 5 \end{array}$$

$$x = 1$$

5) $x = 1$

6) $5x - (4x - 3) = x + 3$

$$5x - 4x + 3 = x + 3$$

$$x + 3 = x + 3$$

6) Infinite Solutions

Solve the equation. Show all algebraic work for full credit. (3 points)

7) $5(2y + 1) = 3(3y + 7)$

$$\begin{array}{r} 10y + 5 = 9y + 21 \\ -9y \quad -9y \end{array}$$

$$\begin{array}{r} y + 5 = 21 \\ -5 \quad -5 \end{array}$$

$$y = 16$$

7) $y = 16$

Solve each inequality and graph the solution on the number line provided. (3 points each)

8) $20 \leq 7x - 1$

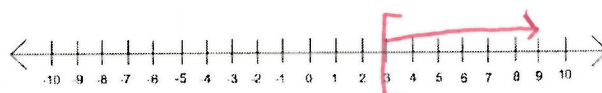
$$\begin{array}{r} +1 \quad +1 \\ 21 \leq 7x \end{array}$$

$$\begin{array}{r} 21 \leq 7x \\ \hline 7 \quad 7 \end{array}$$

$$3 \leq x$$

$$x \geq 3$$

8) $x \geq 3$



9) $0.59x + 7.7 + 0.5x < 0.34x + 3.2$

$$\begin{array}{r} 1.09x + 7.7 < 0.34x + 3.2 \\ -0.34x \quad -0.34x \end{array}$$

$$\begin{array}{r} 0.75x + 7.7 < 3.2 \\ -7.7 \quad -7.7 \end{array}$$

$$\begin{array}{r} 0.75x < -4.5 \\ \hline 0.75 \quad 0.75 \end{array}$$

$$x < -6$$

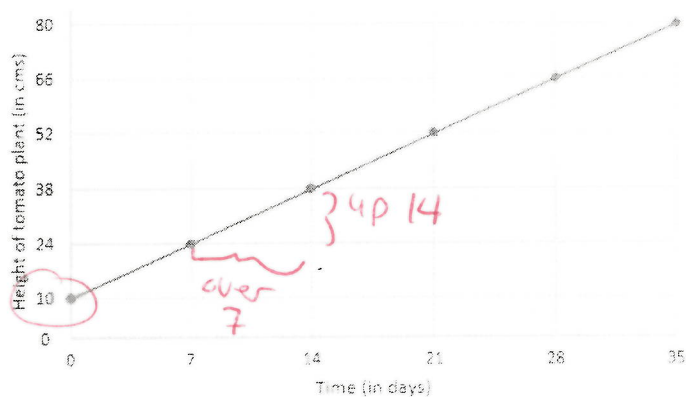
9) $x < -6$



- 10) Write the equation of a line that has a slope of $\frac{5}{3}$ and intersects the y-axis at (0, -1). (2 points)

$$y = \frac{5}{3}x - 1$$

- 11) Write the equation of the line for the graph shown. (2 points)



$$\text{Slope} = \frac{14}{7} = 2$$

$$y = 2x + 10$$

- 12) Find the slope of each line. Then state whether the two lines are parallel, perpendicular or neither. Show your work and justify your answer for full credit. (3 points)

$$y = -2x + 1$$

Slope of first line -2

$$6y = 3x - 8$$

$$\frac{6}{6}y = \frac{3}{6}x - \frac{8}{6}$$

$$y = \frac{1}{2}x - \frac{4}{3}$$

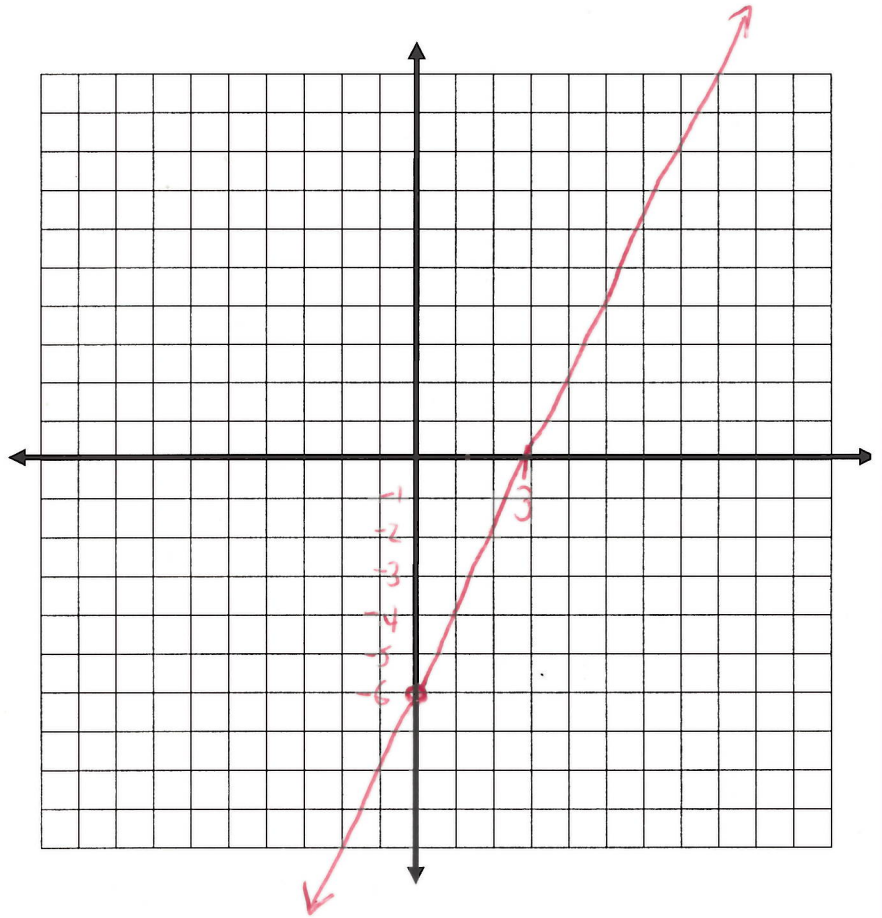
Slope of second line $\frac{1}{2}$

Answer with reason: perpendicular: slopes are
opposite reciprocals

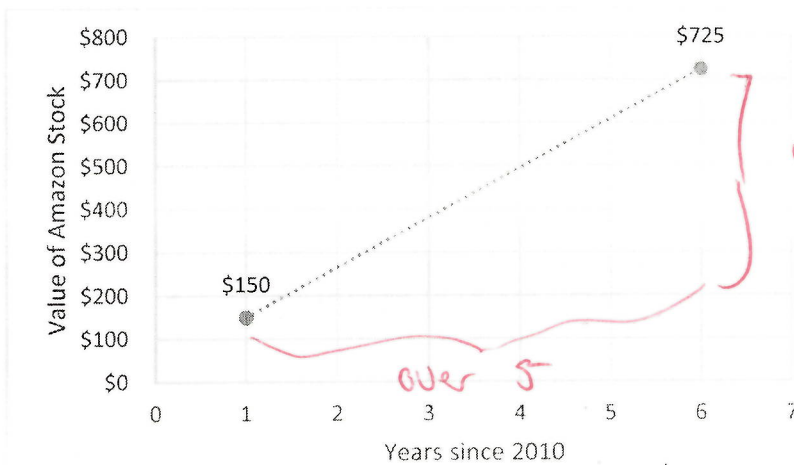
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13) Given the line $y = 2x - 6$, find the following. (1 point each)

- a) x-intercept: (3, 0)
- b) y-intercept: (0, -6)
- c) slope: 2
- d) Graph.



14) Use the graph to find the rate that Amazon stock has been increasing. Include the proper units in your answer. (3 points)



$$\frac{\$575}{5 \text{ years}} = \$115 \text{ per year}$$

14) \$115 per year

15) At Joey Garlic's, a small pizza costs \$10.50 and each additional topping costs \$1.50 each.

a) How much would a small pepperoni pizza cost?

\$ 12 (1 point)

b) How much would a small sausage, peppers, and onion pizza cost?

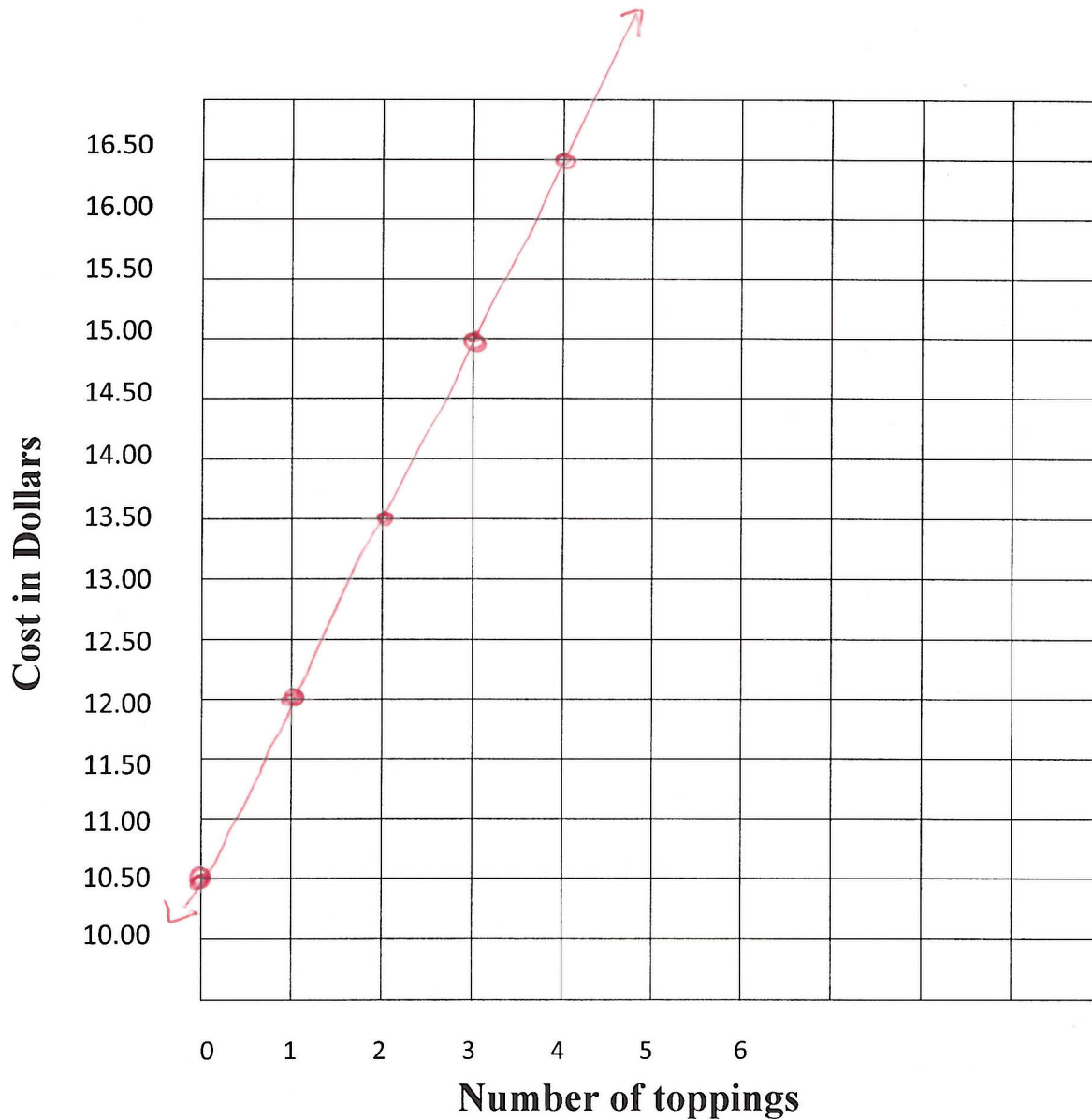
\$ 15 (1 point)

c) Write an equation that models this situation.

Let $y = \text{the cost}$ and let $x = \text{the number toppings}$.

Equation: $y = 1.50x + 10.50$ (2 points)

d) Graph. (2 points)



16) Write the equation of the line that contains the points $(3, -3)$ and $(0, 6)$. (3 points)

$$\text{slope} = m = \frac{6 - (-3)}{0 - 3} = \frac{9}{-3} = -3$$

↑
y-intercept

$$y = -3x + 6$$

17) If $f(x) = x^2 + 3x - 10$, then find $f(0)$ and $f(2)$. (1 point each)

$$a) f(0) = (0)^2 + 3(0) - 10$$

$$f(0) = -10$$

17a) -10

$$b) f(2) = (2)^2 + 3(2) - 10$$

$$4 + 6 - 10$$

$$f(2) = 0$$

17b) 0

18) Solve the system of equations. (3 points)

$$\begin{aligned} y &= 3x + 15 \quad \leftarrow \text{isolated} \\ 6x + 13y &= 60 \end{aligned}$$

using substitution

$$6x + 13(3x + 15) = 60$$

$$6x + 39x + 195 = 60$$

$$45x + 195 = 60$$

$$45x = -135$$

$$\boxed{x = -3}$$

$$y = 3(-3) + 15$$

$$y = -9 + 15$$

$$\boxed{y = 6}$$

Answer:

$$\boxed{(-3, 6)}$$

19) Solve the system of equations. (3 points)

$$\begin{aligned} -3(2x - 3y &= 5) \\ 6x - 9y &= 4 \\ \hline -6x + 9y &= -15 \end{aligned}$$

using Addition/Elim.

$$0 = -11 \quad \leftarrow \text{contradiction}$$

Answer:

No Solutions

Simplify each expression. Write the result using positive exponents. Please circle your final answer.
(2 point each)

20) $x^{-3} \cdot x^3 \cdot x^1$

x

21) $(n^{-2})^{-7}$

n^{14}

22) $(5x^6y)(3x^{-1}y)$

$15x^5y^2$

23) $\frac{48a^5b^7}{12a^5b^3}$

$4b^4$

24) $5a - 2b + c - 2a + 4b - 2c$

$3a + 2b - c$

Perform the indicated operations. Simplify answers fully. (2 points each)

25) $(6x^2 + 9x - 3) - (x^2 + 9x - 6)$

$$\boxed{6x^2 + 9x - 3} \quad \boxed{-x^2 - 9x + 6}$$

$$\boxed{5x^2 + 3}$$

26)

$2x^3(x^2 - 5x + 2)$

$$\boxed{2x^5 - 10x^4 + 4x^3}$$

27)

$(x + 5)(x - 2)$

$$x^2 - 2x + 5x - 10$$

$$\boxed{x^2 + 3x - 10}$$

Perform the indicated operations. Simplify answers fully. (2 points each)

28)

$$(2x + 7)(2x - 7)$$

$$4x^2 - 14x + 14x - 49$$

$$4x^2 - 49$$

29)

$$(3x + 1)^2$$

$$(3x+1)(3x+1)$$

$$9x^2 + 3x + 3x + 1$$

$$9x^2 + 6x + 1$$

30)

$$\frac{21x^4 + 12x^3 - 3x^2}{3x}$$

$$7x^3 + 4x^2 - x$$

Scientific Notation.

30) There are approximately nine quadrillion ants in the world (*Source: National Geographic*). The world population is 7.5 billion (*Source: US Census*). How many ants are there per person in the world? (1 point per part)

- a) Convert nine quadrillion into scientific notation: 9,000,000,000,000,000

$$9 \times 10^{15}$$

15 places

- b) Convert 7.5 billion into scientific notation: 7,500,000,000

$$7.5 \times 10^9$$

9 places

- c) Calculate the number of ants per person by dividing the values in scientific notation you found above.

$$\frac{9 \times 10^{15}}{7.5 \times 10^9} = 1.2 \times 10^6$$

- d) Convert the value found in the previous part back into standard notation.

$$1,200,000 = 1,200,000$$

6 places

Applications. Show your algebraic work for each problem. Include the proper units. Circle your final answer.

- 31) Canton Avenue in Pittsburgh, Pennsylvania is the steepest road in the United States. The road rises 104 feet over a horizontal distance of only 281 feet. Find the grade of Canton Avenue rounded to the nearest percent. (2 points)

$$\frac{104}{281} = 0.37010 = \boxed{37\%}$$

- 32) A rule of thumb for determining how far away a lightning strikes, is to count the seconds between seeing the lightning strike and hearing the thunder. You can then use the following formula:

$$M = \frac{1}{5}t$$

Where M = miles away and t = time in seconds

If there is 4 seconds between seeing lightning and hearing thunder, how far away was the lightning strike rounded to the nearest tenth of a mile? (2 points)

$$t = 4$$
$$M = \frac{1}{5}(4)$$

$$\boxed{M = 0.8 \text{ miles}}$$

$\boxed{4}$

***Choose 4 out of the following 5 word problems to complete. Please put a large X through the problem that you do not want graded. You must use algebra to receive credit and you must show all work for each problem.**
(3 points each)

- 33) You paid \$53.07 for a meal including a 22% tip. How much was the cost before the tip? Round your answer to the nearest cent.

$$\begin{aligned} \text{Meal} + \text{Tip} &= \text{Total} \\ 100\% + 22\% &= 122\% = 1.22 \end{aligned}$$

let x = cost before tip

$$\begin{aligned} 53.07 &= \text{Total} \% \cdot \text{Before} \\ 53.07 &= 1.22x \\ \underline{1.22} \quad \underline{1.22} \\ 43.5 &= x \end{aligned}$$

The meal before tip was
\$43.50

- 34) The equation $C = 3d + 5.25$ can be used to determine the cost of a taxi ride C , in dollars, given the number of miles d that the taxi travels. Determine the distance a taxi drove for a ride that costs \$47.25.

$$\begin{aligned} \text{Find } d: \quad C &= 3d + 5.25 \\ 47.25 &= 3d + 5.25 \\ - 5.25 \quad - 5.25 \\ \hline 42 &= 3d \\ \underline{3} \quad \underline{3} \\ 14 &= d \end{aligned}$$

The trip was 14 miles

- 35) I have a budget of \$400 to buy video games for Christmas. I must buy the system which costs \$250, then I can spend the rest of the money on games. Each game costs \$60; how many games can I buy?

let x = # of games

$$\begin{aligned} 250 + 60x &\leq 400 \\ - 250 \quad - 250 \\ \hline 60x &\leq 150 \end{aligned}$$

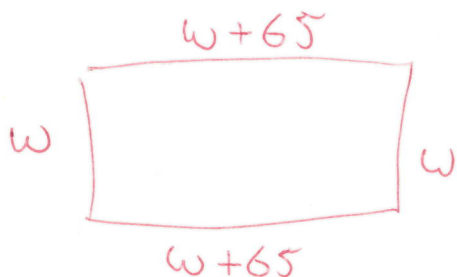
$$\begin{aligned} \underline{60} \quad \underline{60} \\ 60x &\leq 150 \\ \hline x &\leq 2.5 \end{aligned}$$

I can buy 2 games

6 or 9

- 36) The perimeter of a rectangular dog park is 330 feet. The length is 65 feet longer than the width. Find the dimensions of the dog park.

Find length = $l = w + 65$
width = w



$$w + w + 65 + w + w + 65 = 330$$

$$\begin{array}{r} 4w + 130 = 330 \\ -130 \quad -130 \\ \hline 4w = 200 \end{array}$$

$$\frac{4w}{4} = \frac{200}{4}$$

$$w = 50$$

$$l = w + 65 = 115$$

The width is 50 feet
The length is 115 feet

- 37) Jill bought 4 dresses and 3 shirts for \$130. Julie bought 2 dresses and 3 shirts for \$80. What is the price of one dress? What is the price of one shirt?

Dress = x

Shirt = y

#1 $4x + 3y = 130$

#2 $(2x + 3y = 80) - 1$ use addition/sub

#1 $4x + 3y = 130$

#2 $-2x - 3y = -80$

$$2x = 50$$

$$x = 25$$

$$4(25) + 3y = 130$$

$$\begin{array}{r} 100 + 3y = 130 \\ -100 \quad -100 \\ \hline 3y = 30 \end{array}$$

$$\frac{3y}{3} = \frac{30}{3}$$

$$y = 10$$

A dress is \$25

A shirt is \$10

BONUS: (2 points)

Find two integers that have a sum of -11 and a product of 18

Bonus: -2 AND -9