Elementary Algebra
SAMPLE Final Examination

NAME: Answer Key
Fall 2015

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!

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

1) $15 + x = 20$
$-15 \quad -15$
$x = 5$

1) $x = 5$

2) $\frac{3}{4}x + 10 = -20$
$-10 \quad -10$
$\frac{4}{3} \cdot \frac{3}{4}x = -30 \cdot \frac{4}{3}$
$x = -40$

2) $x = -40$

3) $5y + 2 = -2y + 16$
$+2y \quad +2y$
$7y + 2 = 16$
$-2 \quad -2$
$\frac{7y}{7} = \frac{14}{7}$
$y = 2$

3) $y = 2$

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

4) $3(10 - 5y) = 60$

4) $y = -2$

$30 - 15y = 60$

$-30 \quad -30$

$-15y = 30$

$\frac{-15y}{-15} = \frac{30}{-15}$

$y = -2$

5) $12\left(\frac{2}{3}x = \frac{1}{4}x + \frac{1}{3}\right)12$ LCM = 12

5) $x = \frac{4}{5}$

$8x = 3x + 4$

$-3x \quad -3x$

$5x = 4$

$\frac{5x}{5} = \frac{4}{5}$

$x = \frac{4}{5}$

6) $-22 + 2x = -4x - (6x - 14)$

6) $x = 3$

$-22 + 2x = -4x - 6x + 14$

$-22 + 2x = -10x + 14$

$+10x \quad +10x$

$-22 + 12x = 14$

$+22 \quad +22$

$12x = 36$

$\frac{12x}{12} = \frac{36}{12}$

$x = 3$

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

7) $6(y-2) = 3(3y-4) - 3y$

$6y - 12 = 9y - 12 - 3y$

$6y - 12 = 6y - 12$

$0 = 0$

7) Identity

All Real Numbers

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

8) $-9x \geq -4x + 10$

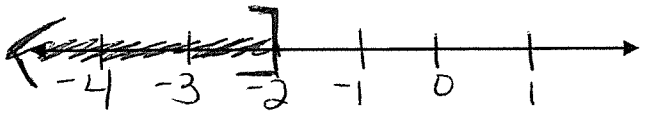
$+4x \quad +4x$

$\frac{-5x}{-5} \geq \frac{10}{-5}$

divide by a negative - reverse

$x \leq -2$

8) $x \leq -2$



9) $100(0.25x - 1.5 > 2.7x + 5.25 - 3.8x)\ 100$ (clear decimals)

$25x - 150 > 270x + 525 - 380x$

$25x - 150 > -110x + 525$

$+110x \quad +110x$

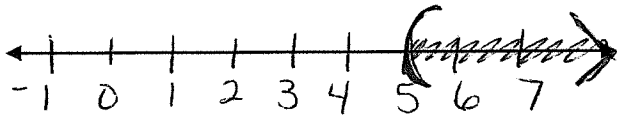
$135x - 150 > 525$

$+150 \quad +150$

$\frac{135x}{135} > \frac{675}{135}$

$x > 5$

9) $x > 5$



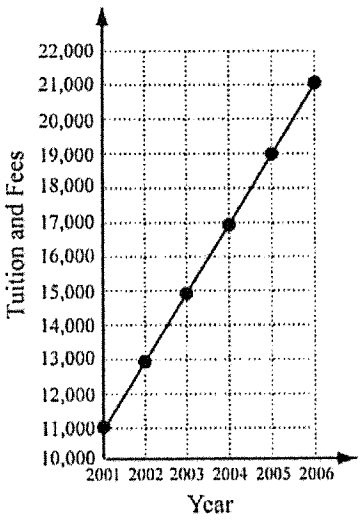
m = -2 b = -8

10) Write the equation of a line that has a slope of -2 and intersects the y-axis at (0, -8). *(2 points)*

$y = mx + b$

$y = -2x - 8$

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



slope (rate) ↓ y-intercept ↓

$y = 2000x + 11{,}000$

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)*

$y = \frac{1}{4}x - 5$

Slope of first line $\frac{1}{4}$

$\frac{4y}{4} = \frac{x}{4} + \frac{4}{4}$ → (need to solve for y to find the slope)

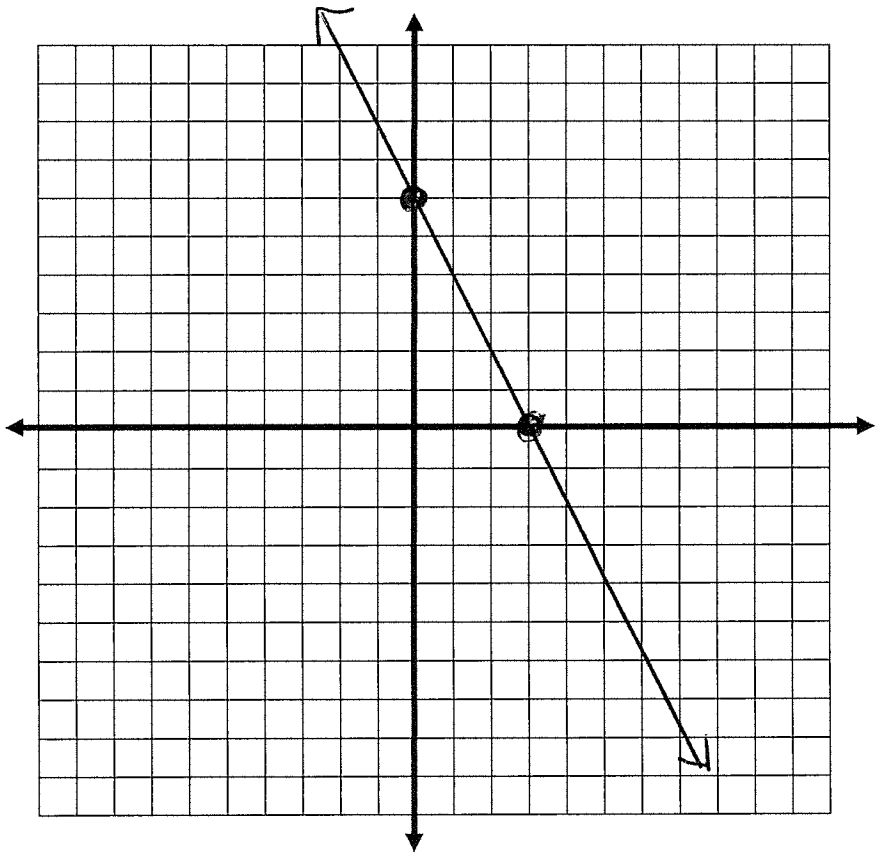
$y = \frac{1}{4}x + 1$

Slope of second line $\frac{1}{4}$

Answer with reason: The lines are parallel because they have the same slope

13) Given the line $4x + 2y = 12$, find the following. *(1 point each)*

x	y
0	6
3	0



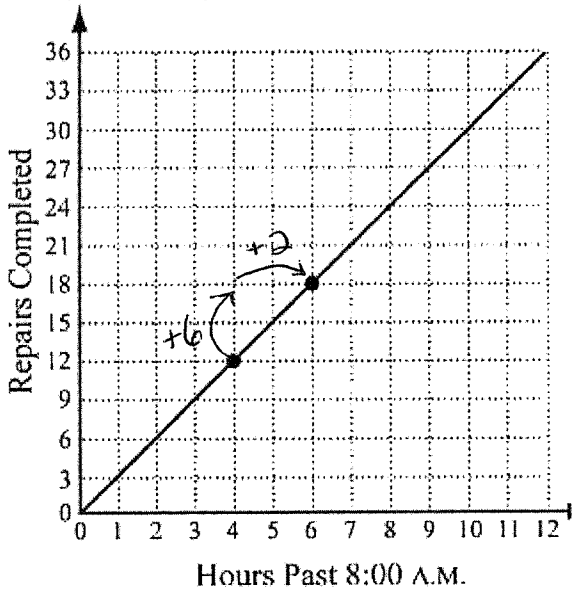
a) x-intercept: (3, 0)

b) y-intercept: (0, 6)

c) slope: −2

d) Graph.

14) Use the graph to find the rate of bike repairs per hour. Please include units in your answer. *(1 point)*



$\frac{\text{rise}}{\text{run}} = \frac{\text{repairs}}{\text{hour}} = \frac{6 \text{ repairs}}{2 \text{ hours}} =$

$= 3$ repairs per hour

14) 3 repairs per hour

15) **The total cost T, in hundreds of dollars, of tuition and fees at many community colleges can be approximated by the equation:**

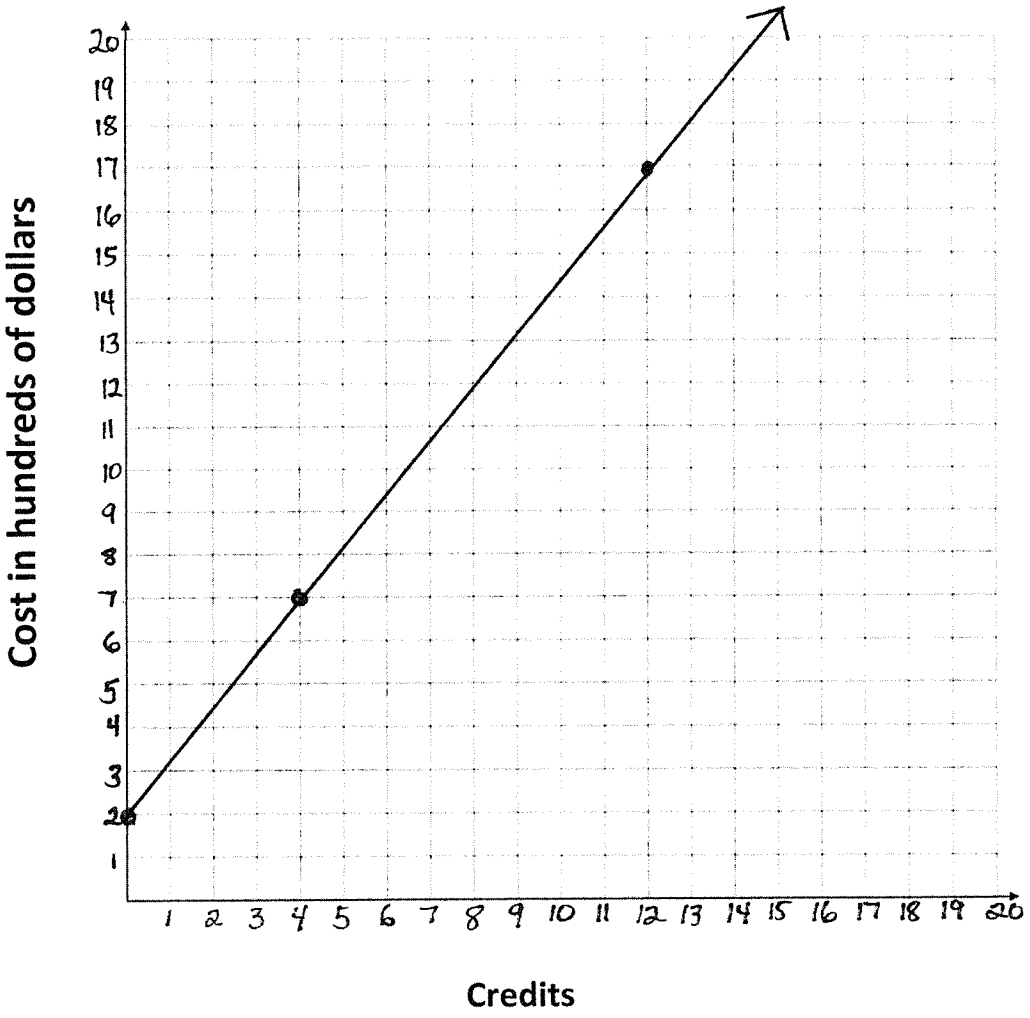
$$T = \frac{5}{4}c + 2$$

where c is the number of credits for which a student registers.

a) Graph the equation. *(2 points)*

b) Use the graph to estimate the cost of tuition and fees when a student registers for 12 credits. $1,700
(1 point)

c) Find the rate, in dollars per credit, that the tuition increases. $125 per credit
(1 point)



$x_1 y_1 \quad x_2 y_2$

16) Write the equation of the line that contains the points (-1, 4) and (5, -8). *(3 points)*

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-8-4}{5-(-1)} = \frac{-12}{6} = -2$$

$y = mx + b$

$4 = (-2)(-1) + b$

$4 = 2 + b$

$2 = b$

$y = -2x + 2$

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

a) $f(0) = 3(0)^2 - 2 = -2$ 17a) -2

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

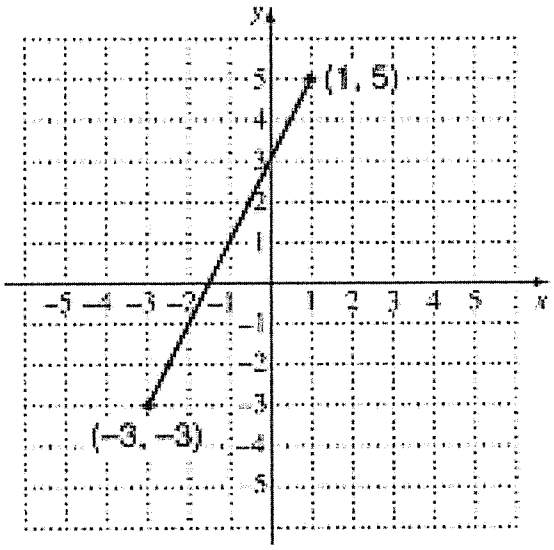
$3(4) - 2$

$12 - 2$

10

17b) 10

18) What is the domain and range of the following function? Write your answer in interval notation. *(1 point each)*



Domain: $[-3, 1]$

Range: $[-3, 5]$

19) Find the point of intersection of the two lines using the substitution method. (3 points)

$2x + 3y = 1$
$y = x - 8$

$2x + 3(x-8) = 1$

$2x + 3x - 24 = 1$

$5x - 24 = 1$
$+24 \quad +24$

$\frac{5x}{5} = \frac{25}{5}$

$x = 5$

$y = x - 8$
$y = 5 - 8$
$y = -3$

19) Point of intersection: $(5, -3)$

20) Find the point of intersection of the two lines using the elimination (addition) method. *(3 points)*

$4(6x + y = 10)$ → $24x + 4y = 40$
$x - 4y = 10$ → $+\ x - 4y = 10$

$\frac{25x}{25} = \frac{50}{25}$

$x = 2$

$x - 4y = 10$

$2 - 4y = 10$
$-2 \quad -2$

$-4y = 8$
$\frac{-4}{-4} \quad \frac{8}{-4}$

$y = -2$

20) Point of intersection: $(2, -2)$

21) Express 7,200,000 in scientific notation. *(1 point)*

21) 7.2×10^6

22) Write 5.17×10^{-5} in standard form (decimal notation). *(1 point)*

22) 0.0000517

23) Multiply. Write your answer in scientific notation. *(2 points)*

$(1.9 \times 10^6)(4.5 \times 10^{-11})$

8.55×10^{-5}

23) 8.55×10^{-5}

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

24) $y^5 \cdot y \cdot y^{-8}$

$y^{-2} = \frac{1}{y^2}$

25) $(4^3)^5$

4^{15}

26) $(-2x^4y^{-6})^3$

$-8x^{12}y^{-18}$

$= \frac{-8x^{12}}{y^{18}}$

27) $\frac{10\,x^{-5}\,y^6}{15\,x^2y}$

$\frac{2y^5}{3x^7}$

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

28) $18x + 9 - 12x^2 - 12x + 6 - 11x^2$

$-23x^2 + 6x + 15$

29) $(-10x^2 + x + 7) - (5x^2 - 4x + 3)$

$-10x^2 + x + 7 - 5x^2 + 4x - 3$

$-15x^2 + 5x + 4$

30) $2y(y^2 - 3y + 10)$

$2y^3 - 6y^2 + 20y$

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

31) $(4x-3)^2$

$(4x-3)(4x-3)$

$16x^2-12x-12x+9$

$16x^2-24x+9$

32) $(6p+5)(6p-5)$ $= 36p^2-30p+30p-25$

$=36p^2-25$

33) $(5x-y)(2x-3y)$

$10x^2-15xy-2xy+3y^2$

$10x^2-17xy+3y^2$

34) $\frac{21x^4+15x^3-24x^2}{-3x} = \frac{21x^4}{-3x}+\frac{15x^3}{-3x}-\frac{24x^2}{-3x}$

$-7x^3-5x^2+8x$

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

35) A road rises 586 feet vertically over a horizontal distance of 8,617 feet. What is the grade of the road as a percent? Round to the nearest tenth of a percent. *(2 points)*

$$\frac{\text{rise}}{\text{run}} = \frac{586}{8617} = .0680 = 6.8\%$$

36) A parking garage charges \$10 to park plus \$2 for each additional hour. Write the equation of the line that models this relationship. *(2 points)*

$$y = 2x + 10$$

37) When all n teams in a baseball league play every other team twice, a total of G games are played, where $G = n^2 - n$. If a baseball league has 12 teams and all teams play each other twice, how many games are played? *(2 points)*

$$G = (12)^2 - 12$$
$$= 144 - 12$$
$$= 132 \text{ games}$$

38) You paid $68.94 for a meal including a 15% tip. How much was the cost before the tip? Round your answer to two decimal places. *(3 points)*

x = cost before tip

$x + .15x = 68.94$

$\frac{1.15x}{1.15} = \frac{68.94}{1.15}$

$x = 59.95$

$59.95 is the cost before tip

39) The equation $T = \frac{1}{4}N + 40$ can be used to determine the temperature T, in degrees Fahrenheit, given the number of times N that a cricket chirps per minutes. Determine the number of chirps per minute for a temperature of 80 °F. *(3 points)*

$T = \frac{1}{4}N + 40$

$80 = \frac{1}{4}N + 40$

$-40 \quad -40$

$4 \cdot 40 = \frac{1}{4}N \cdot 4$

$160 = N$

160 chirps per minute

40) Karen's financial aid stipulates that her tuition not exceed $4,000. If her local community college charges a $100 registration fee plus $1,250 per course, what is the greatest number of courses for which Karen can register? *(3 points)*

x = number of courses

$1250x + 100 \leq 4000$

$-100 \quad -100$

$\frac{1250x}{1250} \leq \frac{3900}{1250}$

$x \leq 3.12$

The greatest number of courses is 3.

41) The Bronx Zoo charges \$15 for adults and \$11 for children. One July day, a total of \$11, 920 was collected from 960 visitors. How many adult admissions were there? *(3 points)*

x = number of adult tickets
y = number of child tickets

$-15(x + y = 960)\ -15$
$15x + 11y = 11{,}920$

$-15x - 15y = -14{,}400$
$+\ 15x + 11y = 11{,}920$

$-4y = -2480$
$\frac{-4y}{-4} = \frac{-2480}{-4}$

$y = 620$

$x = 340$ adult tickets

BONUS: ***(3 points)***

Write the next 3 numbers in the pattern 1, 4, 9, 16, 25, 36, 49, 64
(perfect squares)