Name: Key

Recitation Instructor:

Recitation Day and Time:

Studio College Algebra – Exam 1 – February 2, 2016

Directions: You will find 16 problems listed below. Each problem is worth 5 points. No notes/books/friends are allowed. Graphing calculator models above the level of a TI-84 plus are not allowed (in particular, calculators with a built in CAS and/or QWERTY keyboard are not allowed). You have one hour to complete this exam.

1. Consider $g(x) = 5x^2 - dx$, where d is some external parameter. Answer the following:

(a) Find $g(-2)$. $\quad g(-2) = 5(4) - d(-2) = \underline{20 + 2d}$

(b) Find $g(-1)$. $\quad g(-1) = 5(1) - d(-1) = \underline{5 + d}$

(c) Find $g(0)$. $\quad g(0) = 0$

(d) Find $g(1)$. $\quad g(1) = 5(1) - d(1) = \underline{5 - d}$

(e) Find $g(2)$. $\quad g(2) = 5(4) - d(2) = \underline{20 - 2d}$

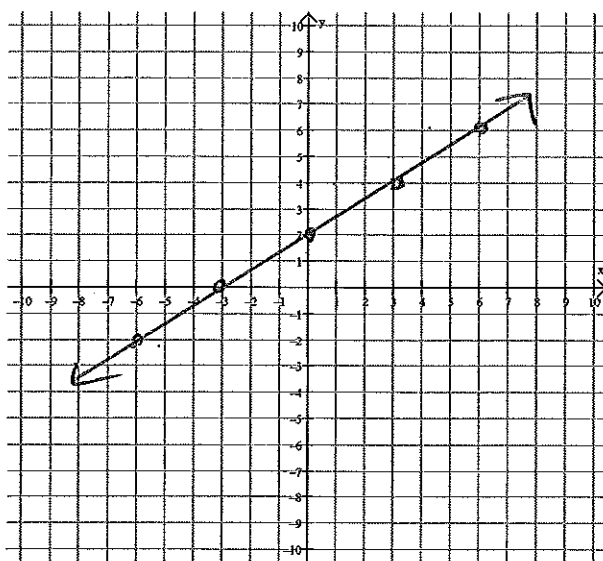2. Solve for x in the equation $4(2x + 1) = 3x - 9$.

$$8x + 4 = 3x - 9$$
$$5x = -13$$
$$\boxed{x = \frac{-13}{5}}$$

3. Graph $-2x + 3y = 6$ on the grid below. Include all intercepts.

$3y = 2x + 6.$

$y = \frac{2}{3}x + 2$

4. Solve $|x - 6| = 2x + 8$ and check your answers.

$x - 6 = 2x + 8$ OR $x - 6 = -2x - 8$

$-14 = x$ OR $3x = -2$

$x = -\frac{2}{3}$

Check:

Left: $|-14 - 6| = 20$

Right: $2(-14) + 8 = -20$

$x = -14$ is
   NOT a solution

check:

Left: $|-\frac{2}{3} - 6| = \frac{20}{3}$

Right: $2(-\frac{2}{3}) + 8$

$= -\frac{4}{3} + \frac{24}{3}$

$= \frac{20}{3}$ ✓

Only $x = -\frac{2}{3}$
   works

5. Solve $|x - 1| < 7$.

$$-7 < x - 1 < 7$$

$$-7 < x - 1 \quad \text{AND} \quad x - 1 < 7$$

$$-6 < x \quad \text{AND} \quad x < 8$$

$$\boxed{-6 < x < 8}$$

6. Solve $|x + 9| > 4$.

$$x + 9 > 4 \quad \text{OR} \quad x + 9 < -4$$

$$\boxed{x > -5 \quad \text{OR} \quad x < -13}$$

7. A truck depreciates in value according to a linear model. If the initial value of the truck is $28,000, and the value twenty years later is $0, what was the depreciated value of the truck after 12 years?

(t, y): t: time in years
y: $ value of truck

$(0, 28000)$
$(20, 0)$

$$\text{Slope} = \frac{-28000}{20} = -\$1400/\text{year}.$$

After 12 yrs: $28000 - 1400 (12)$

$$= \$11,200$$

8. Suppose a line passes through (1,2) and (-5,8). What is the equation of the line passing through these points?

$$y = mx + b$$

$$m = \frac{8-2}{-5-1} = \frac{6}{-6} = -1.$$

$$y = -x + b.$$

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

$$3 = b.$$

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

9. What is the domain of the function $f(x) = \dfrac{4}{9x + 3}$?

$$9x + 3 = 0.$$

$$9x = -3$$

$$x = \frac{-3}{9} = \frac{-1}{3}$$

Domain: $x \neq -\frac{1}{3}$.

10. The weekly profit function for a business is $P(x) = 15x - 300$, where x is the number of customers. How many more customers must the business add if it wants to increase profits by \$750 per week?

The marginal profit for this linear function is \$15 per customer.

So $\dfrac{750}{15} = \boxed{50 \text{ customers}}$

is the answer.

11. The temperature T in degrees Fahrenheit inside a concert hall m minutes after a power outage during a winter concert is given by $T(m) = -0.4m + 80$. What is the meaning of the slope in this function?

The temperature decreases .4° every minute after the power goes out.

12. The equation $5F - 9C = 160$ gives the relationship between Fahrenheit and Celsius temperature measurements, where F is the temperature in Fahrenheit and C is the temperature in Celsius. What Celsius measure corresponds to a Fahrenheit measure of 71 degrees? Round your answer to the nearest tenth.

$5(71) - 9C = 160.$

$5(71) - 160 = 9C$

$195 = 9C$

$C \approx 21.67°.$

13. Suppose the number of cell phone subscribers (in millions) between the years 1993 and 1997 is described by the model $P(x) = 12.33x + 29$, where x is the number of years since 1995. Find and interpret the meaning of $P(3)$.

$$P(3) = 12.33(3) + 29$$
$$= 65.99$$

In 1998 there were 65.99 million cell phone subscribers

14. Suppose the total cost function for a certain product is given by $C(x) = 15x + 100$ and the revenue function for the product is given by $R(x) = 25x$. Find a profit function for this situation.

$$\text{Profit} = \text{Revenue} - \text{Cost}$$
$$P(x) = R(x) - C(x)$$
$$= 25x - (15x + 100)$$
$$= 10x - 100.$$

15. Find M if $x = 5$ is a solution for $Mx + 2 = 7x - M$.

$$M(5) + 2 = 7(5) - M$$
$$5M + 2 = 35 - M$$
$$6M = 33$$
$$M = \frac{33}{6} = \frac{11}{2}$$

$$\boxed{M = \frac{11}{2}}$$

16. In a controlled lab environment, some organisms exhibit constant growth over a specific time period. Suppose a certain organism starts out weighing 2 mg, and grows to 8 mg over a 24 hour time period. Find a linear model that describes the growth of the organism for $0 \le t \le 24$ hours. (Hint: In other words, find a function $f(t) = mt + b$, with m and b filled in. You will have to figure out what m and b are for this situation.)

$$(t, f(t)) : \quad t: \text{ time}$$
$$f(t): \text{ weight}$$

$$(0, 2)$$
$$(24, 8)$$

$$f(t) = mt + b; \quad m = \frac{6}{24} = \frac{1}{4}.$$
$$f(t) = \frac{1}{4}t + b.$$

$$\boxed{f(t) = \frac{1}{4}t + 2}$$

$$0 \le t \le 24, \quad f(t): \text{ weight in mg}.$$