MAC 1105 Test 1 Name Key
(D. Howard 3-16)

Show all work for credit.

1. Find the equation of the line in slope-intercept form that is perpendicular to the line $2x - 3y = 4$ and is passing through the point $(0, 5)$.

6

Find slope

$2x - 3y = 4$

$-3y = -2x + 4$

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

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

$m = 2/3$

$\perp m = -3/2 \quad (0,5)$

$y = mx + b$

$b = 5$

$\boxed{y = -\frac{3}{2}x + 5}$

2. Suppose that the cost C (in dollars) of removing $p\%$ of the particulate pollution from the smokestack of a power plant is given by $C(p) = \frac{23700p}{100-p}$.

a.) Find the domain of the equation. cannot divide by zero

3

$100 - p \neq 0$

$100 \neq p$

$(-\infty, 100) \cup (100, \infty)$

or

$[0, 100)$

b.) Evaluate $C(90) =$

3

$p = 90$

$C(90) = \frac{23700(90)}{100-90} = \frac{2133000}{10} = \boxed{213{,}300}$

c.) Interpret the meaning of $C(90)$ in the context of the problem.

3

In order to remove 90% of the particulate polution, the cost will be \$ 213, 300.

3. A couple wants to buy a $35,000 car and can borrow the money for the purchase at 8%, paying it off in 3, 4, or 5 years. The table below gives the monthly payment and total cost of the purchase (including the loan) for each of the payment plans.

Years, *t*	Monthly Payment, *P(t)*	Total Cost, *C(t)*
3	1096.78	39,484.04
4	854.46	41,014.08
5	709.68	42,580.80

3 a.) Find $P(3) =$ 1096.78

b.) What is *t* if $C(t) = 41{,}014.08$?

3 t = 4 years = 48 months

4. Given the function $f(x) = x^3 + 3x^2 - 60x$

a.) Complete the table.

3

x	0	1	2
$f(x)$	0	-56	-100

b.) State one possible viewing window to show a complete graph of the function.

3 Must see x intercepts x = -9.39, 0, 6.39

must see min = -130.5 and max = 254.5

X ∈ [-10, 10] x 1 Y ∈ [-200, 300] x 100

c.) Find the maximum point between $x = -10$ and $x = 0$. Round to two decimal places for both *x* and *y* coordinates.

3 max point = (-5.58, 254.47)

5. A company charting its profits notices that the relationship between the number of units sold x and the profit P is linear. When 300 units are sold, the profit is \$4650 and when 375 units are sold, the profit is \$9000.

a.) Find the rate of change. (300, 4650) (375, 9000)

3 $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{9000 - 4650}{375 - 300} = \dfrac{4350}{75} = 58$ $\dfrac{\$58 \text{ profit}}{1 \text{ units}}$

b.) Interpret the meaning of the rate of change in the context of the problem.

3 For each additional unit sold, an additional \$58 is made in profit.

c.) Find the equation of the linear function in point-slope form.

$y - y_1 = m(x - x_1)$

3 $y - 4650 = 58(x - 300)$

OR

$y - 9000 = 58(x - 375)$

d.) Use your equation from above to predict the profit when 400 units are sold.

$x = 400$

$y - 4650 = 58(400 - 300)$

3 $y - 4650 = 58(100)$ $y = \$10450$

$y - 4650 = 5800$

6. a.) Sketch a graph of a line with zero slope.

any horizontal line

3 

b.) Sketch a graph of a line with negative slope.

any decreasing line

3 

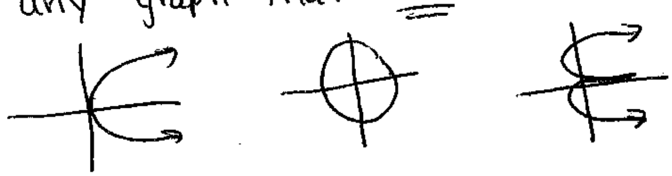
c.) Find the equation of the vertical line that passes through the point (3, −4).

$x = \#$

3 $x = 3$

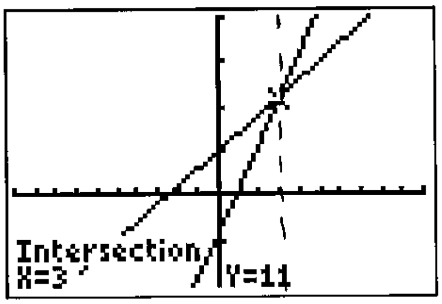
d.) Give an example of a graph that is NOT a function.

any graph that fails the vertical line test.

3 

7. Given the graph below, solve each of the following.

Y2 Y1



Y1 Y2

3

3

3

a.) Y1 = Y2 $x = 3$

b.) Y1 < Y2 $x > 3$

c.) Y1 > Y2 $x < 3$

8. Given $\frac{5}{6}x - \frac{5}{2} - x = 1 - \frac{1}{9}x$

a.) Solve **algebraically**.

5

$$-\frac{1}{6}x - \frac{5}{2} = 1 - \frac{1}{9}x$$

$$+\frac{1}{9}x \quad +\frac{5}{2} \quad +\frac{5}{2} \quad +\frac{1}{9}x$$

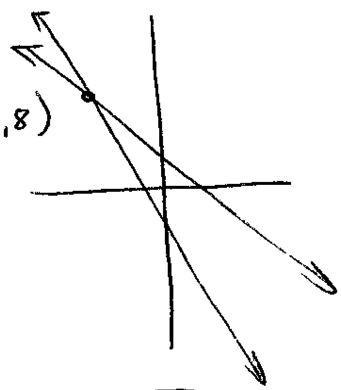
$$\frac{-\frac{1}{18}x}{-\frac{1}{18}} = \frac{\frac{7}{2}}{-\frac{1}{18}}$$

$x = -63$

b.) Solve **graphically or numerically**.

5 graph

(-63, 8)



$X = -63$

$Y1 = \left(\frac{5}{6}\right)x - 5/2 - x$

$Y2 = 1 - (1/9)x$

num :

X	Y1	Y2
-64	8.17	8.11
-63	8	8
-62	7.83	7.89

$X = -63$

9. The table shows the number of millions of people in the US who lived below the poverty level for selected years.

Year	1970	1975	1980	1986	1990	1995	2000	2004
Persons (millions)	25.4	25.9	29.3	32.4	33.6	36.4	31.1	37.0
	X=0	x=5	x=10	X=16	x=20	x=25	x=30	x=34

a.) Find the linear model (linear regression), using *x* as the number of years after 1970. Round all numbers to three decimal places.

3

$y = .316x + 25.860$

b.) How many millions of persons under the poverty level does the **model** predict for the year 2000? Round to one decimal place.

CALC #1

$x = 30$

3

$y = 35.3$ million

c.) How many persons under the poverty level did the **data** observe for the year 2000?

$y = 31.1$ million

3

from table given

d.) Does the **model** exactly or nearly fit the **data**? What generalization can be made about using models for predictions?

3 nearly fit. The regression is an approximation of the data.

10. A concert promoter needs to make \$84,000 from the sale of 2400 tickets. The promoter charges \$30 for some tickets and \$45 for others. How many of each priced ticket were sold?

5 a.) Set up a system of equations that model this scenario.

$$\begin{cases} 30x + 45y = 84000 \\ x + y = 2400 \end{cases}$$

5 b.) Solve the system of equations by a **method of your choice.**

elimination :

$$\begin{cases} 30x+45y = 84000 \\ -30\,(x+y) = (2400)(-30) \end{cases}$$

$$30\cancel{x} + 45y = 84000$$
$$+ \ -3\cancel{0}x - 30y = -72000$$
$$15y = 12000$$
$$y = 800$$
$$x = 2400 - 800 = 1600$$

Substitution :

$$\begin{cases} 30x + 45y = 84000 \\ x + y = 2400 \end{cases}$$

$$x = 2400 - y$$
$$30(2400 - y) \overset{+45y}{=} 84000$$
$$72000 - 30y + 45y = 84000$$
$$72000 + 15y = 84000$$
$$15y = 12000$$
$$y = 800$$
$$x = 2400 - 800 = 1600$$

graphing :

$$30x + 45y = 84000$$
$$y1 = \frac{(-30x + 84000)}{45}$$
$$x + y = 2400$$
$$y2 = 2400 - x$$

(1600, 800)

$x = 1600$
$y = 800$

11. The actual time *t* served in prison for a serious crime can be approximated by a function of the sentence length *s*, with $t = 0.55s - 2.886$ where *s* and *t* are both measured in months. How many months should a judge sentence a convicted criminal so that the criminal will actually have to serve between 4 and 6 years? Round to the nearest month.

5

time served, sentence length

$$t = 0.55s - 2.886$$

4 years = 48 months

6 years = 72 months

$$48 < 0.55s - 2.886 < 72$$
$$+2.886 \qquad + 2.886 \qquad +2.886$$

$$\frac{50.886}{.55} < \frac{0.55s}{.55} < \frac{74.886}{.55}$$

$$92.52 < s < 136.156$$

$$93 < s < 136$$

Between 93 and 136 months