All work must be shown to earn full credit.

Math 1320

NAME Answer Key

Instructor: Tuesday J. Johnson

Fall 2018

9:00 AM version

Exam 1

Thursday, September 27th, 2018

#1	/20
#2	/20
#3	/20
#4	/20
#5	/20
Total	/100

You may use a calculator and the provided formula sheet on this exam. **Show all of your work to receive full/partial credit!**

All work must be shown to earn full credit.

1) Given $g(x) = x^2 + 6x + 5$, find

$g(\ ) = (\ )^2 + 6(\ ) + 5$

a) $g(0)$

$$g(0) = (0)^2 + 6(0) + 5$$
$$= \boxed{5}$$

b) $g(-1)$

$$g(-1) = (-1)^2 + 6(-1) + 5$$
$$= 1 - 6 + 5 = \boxed{0}$$

c) $g(-3)$

$$g(-3) = (-3)^2 + 6(-3) + 5$$
$$= 9 - 18 + 5$$
$$= \boxed{-4}$$

d) $g(x+h)$, simplify.

$$g(x+h) = (x+h)^2 + 6(x+h) + 5$$
$$= (x+h)(x+h) + 6x + 6h + 5$$
$$= x^2 + xh + xh + h^2 + 6x + 6h + 5$$
$$= x^2 + 2xh + h^2 + 6x + 6h + 5$$

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2) Your college newspaper, *The Collegiate Investigator*, has fixed production costs of $72 per edition and marginal printing and distribution costs of 38¢ per copy. *The Collegiate Investigator* sells for 48¢ per copy.

10 a) Write down the associated cost function $C(x)$ in dollars.

$C(x) = 0.38x + 72$

Write down the revenue function $R(x)$ in dollars.

$R(x) = 0.48x$

Write down the profit function $P(x)$ in dollars.

$P(x) = 0.10x - 72$

$P = R - C = 0.48x - (0.38x + 72)$

5 b) What profit (or loss) results from the sale of 500 copies of *The Collegiate Investigator*?

$P(500) = 0.10(500) - 72$
$= 50 - 72 \quad = -22$

loss of $22

5 c) How many copies should be sold in order to break even?

$P = 0$ or $R = C$ both give same solution

$0.10x - 72 = 0$
$\quad +72 \quad +72$
$0.10x = 72$
$\frac{0.10x}{.10} = \frac{72}{.10}$

$x = 720$ copies

All work must be shown to earn full credit.

3) The following table shows worldwide sales of a certain type of cell phones and their average wholesale process in 2013 and 2017.

Year	2013	2017
Selling Price ($)	315	255
Sales (millions)	1,210	1,810

a) Use the data to obtain a linear demand function for this type of cell phones.

12

$q(p) = -10p + 4360$

$(315, 1210) \quad (255, 1810)$

$m = \frac{1810 - 1210}{255 - 315} = \frac{600}{-60} = -10$

$1210 = -10(315) + b$

$1210 = -3150 + b$

$+3150 \qquad +3150$

$4360 = b$

b) Use your demand equation to predict sales to the nearest million phones if the price is raised to $395.

6

$q(395) = -10(395) + 4360$

$= -3950 + 4360$

$= 410$ million

c) Fill in the blanks: For every $1 increase in price, sales of cell phones decrease by 10 units

2

All work must be shown to earn full credit.

4) The Better Baby Buggy Co. has just come out with a new model, the Turbo. The market research department predicts that the demand equation for Turbos is given by

$$q = -3p + 468,$$

where q is the number of buggies the company can sell in a month if the price is $\$p$ per buggy.

10 a) At what price should it sell the buggies to get the largest revenue?

$R = p \cdot q$

$R(p) = p(-3p + 468)$

$R(p) = -3p^2 + 468p$

$p = -\frac{b}{2a} = \frac{-(468)}{2(-3)} = \frac{-468}{-6} = 78$

price $= \boxed{\$78}$

10 b) What is the largest monthly revenue?

$R(78) = -3(78)^2 + 468(78)$

$= -3(6084) + 468(78)$

$= -18252 + 36504$

$= \boxed{\$18,252}$

All work must be shown to earn full credit.

5) The rate of auto thefts **doubles** every 7 months.

a) Determine, to two decimal places, the base b for an exponential model $y = Ab^t$ of the rate of auto thefts as a function of time in months.

$b = 1.10$

doubles $\Rightarrow$ 2

every 7 months leads to $2^{1/7} = 1.104089514$

b) Find the tripling time to the nearest tenth of a month.

Isolate $\dfrac{3A}{A} = \dfrac{A(1.10)^t}{A}$

$3 = (1.10)^t$

Convert $t = \log_{1.10}(3)$

Change of base / evaluate $t = \dfrac{\log(3)}{\log(1.10)} = 11.5267$

about 11.5 months to triple

Formulas for Math 1320 Exam 1

Equation of a linear function: $y = mx + b$ or $f(x) = mx + b$, where $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Cost function: $C(x) = mx + b$, where m is the marginal cost and b is the fixed cost, and $m = \frac{C_2 - C_1}{x_2 - x_1}$.

Revenue: $R(x) = mx$, where m is the marginal revenue. Also, $R = (\text{price}) \times (\text{quantity})$.

Profit: $P(x) = R(x) - C(x)$.

Supply and demand: Both have the form $q = mp + b$. For demand, $m < 0$; for supply $m > 0$. In both cases, $m = \frac{q_2 - q_1}{p_2 - p_1}$.

Parabolas: Functions have the form $f(x) = ax^2 + bx + c$.

- Vertex at the point $\left(-\frac{b}{2a}, f\left(\frac{-b}{2a}\right)\right)$.
- y-intercept at $(0, c)$
- To find x-intercepts, solve $ax^2 + bx + c = 0$ for x.

Exponential Growth and Decay: Formulas are $Q(t) = Q_0 e^{kt}$ (growth) and $Q(t) = Q_0 e^{-kt}$ (decay), where Q_0 is the quantity at time $t = 0$. For growth, $k = \frac{\ln(2)}{\text{doubling time}}$ and for decay, $k = \frac{\ln(2)}{\text{half-life}}$.

Alternate form for exponential functions is $y = Ab^x$.