1) Your college newspaper, *The Collegiate Investigator*, has fixed production costs of $70 per edition and marginal printing and distribution costs of 40¢ per copy. *The Collegiate Investigator* sells for 50¢ per copy.

a) Write down the associated cost, revenue, and profit functions.

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

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

2) Let $f(x) = x^2 + 3x + 1$

a) $f(0)$

b) $f(-1)$

c) $f(a)$

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

3) Find the equation of the line that passes through the points $(-2, 1)$ and $(2, 3)$.

4) The XYZ Widget factory can produce 80 widgets in a day at a total cost of $8,000 and it can produce 100 widgets a day at a total cost of $10,000.

a) What are the company's daily fixed costs and marginal cost per widget?

b) Use the cost function to estimate the cost of manufacturing 400 widgets in a day.

5) You can sell 100 pet rocks per week if they are marked at $1 each, but only 40 each week if they are marked at $2 per rock. Your rock supplier is prepared to sell you 30 rocks each week if they are marked at $1/rock, and 120 each week if they are marked at $2 per rock.

a) Write down the associated linear demand and supply functions.

b) At what price should the rocks be marked so that there is neither a surplus nor a shortage of rocks?

6) The following table shows worldwide sales of a certain type of cell phones and their average wholesale process in 2014 and 2018.

Year	2014	2018
Selling Price ($)	325	245
Sales (millions)	1,110	1,910

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

$q(p) =$

b) Use your demand equation to predict sales to the nearest million phones if the price is raised to $375.

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

7) Sketch the graph of the quadratic function, indicating the coordinates of the vertex, the y-intercept, and the x-intercepts (if any).

$$f(x) = -x^2 + 4x - 4$$

8) 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

$$q = -4p + 480,$$

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

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

b) What is the largest monthly revenue?

9) Actinium is a highly radioactive element. The most common isotope of actinium is produced as a by-product in nuclear reactors, and has a half-life of 21.77 years.

a) Obtain an exponential decay model for actinium-227 in the form $Q(t) = Q_0 e^{-kt}$. (Round k to four decimal places.)

b) About 20 milligrams of actinium are produced in a certain nuclear reactor. Use your model to predict how long it will take for this amount of actinium to decay to one milligram.

10) The half-life of cobalt 60 is 5 years.

a) Obtain an exponential model for cobalt 60 in the form $Q(t) = Q_0 e^{-kt}$. (Round coefficients to three significant digits.

b) Use your model to predict, to the nearest year, the time it takes for one third of the sample of cobalt 60 to decay.

11) The rate of auto thefts **triples** every 9 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.

$b =$

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

12) There were 3,500 bacteria in a Petri dish (at time $t = 0$ hours). Four hours later, there were 5,500 bacteria in the dish. Find the mathematical model that represents the number of bacteria after t hours. It's an exponential formula of the form $Q(t) = Q_0 e^{kt}$.
Round k to 4 decimal places. Include the units in the answer.