**1.** Solve the following systems of linear equations algebraically. Show all your work. If the system is dependent or inconsistent, clearly state so.

**(a).** $\begin{cases} -3x + 2y = -4 \\ 2x + 4y = 8 \end{cases}$ $x = 2, y = 1$

**(b).** $\begin{cases} x - 3y = 5 \\ -3x + 9y = -10 \end{cases}$ Inconsistent; No Solution

**2.** A movie theater charges \$9 for adults and \$5.50 for children. On the opening day for the latest Harry Potter movie, the theater fills all 500 of its seats. If they collected \$3870, how many children and how many adults watched the movie? Set up, ***but do not solve***, the system of equations needed to determine how many children and how many adults watched the movie. Clearly indicate what $x$ and $y$ represent.

Let $x$ = number of adults and $y$ = number of children. Then $\begin{array}{rcl} x + y &=& 500 \\ 9x + 5.50y &=& 3870 \end{array}$

**3.** A manufacturer of DVD players has monthly fixed costs of \$9800 and variable costs of \$65 per unit for one particular model. The company sells this model to dealers for \$100 each.

**(a).** For this model DVD player, write the function for the monthly total costs, revenue, and profit.
$C = 65x + 9800; R = 100x; P = 35x - 9800$

**(b).** Find $R(250)$ and interpret the answer. $R(250) = 25000$. The revenue from selling 250 units is \$25,000.

**(c).** Find the marginal profit and write a sentence that explains its meaning. $\overline{MP} = 35$. Each additional unit sold will result in \$35 additional profit.

**(d).** Find the break-even point. 280 units

**4.** Find the market equilibrium point for the following demand and supply functions.

**(a).** Demand: $p = 600 - 3q$ Supply: $p = 21q + 96$ $p = 537, q = 21$

**(b).** Demand: $p = 2q^2 + q + 40$ Supply: $p = 200 - q - \frac{1}{4}q^2$ $p = 176, q = 8$

**5.** Solve the following equations for $x$: **(a).** $x^2 - 6 = x + 6$ $x = 4, -3$ **(b).** $3x^2 - 10x + 8 = 0$ $x = 2, \frac{4}{3}$

**6.** Given the parabola $y = -3x + x^2$ [Do this problem without a calculator.]

**(a).** Find the $x$ and $y$ coordinates of the vertex. $(\frac{3}{2}, -\frac{9}{4})$ **(b).** Is it a maximum or a minimum? min.

**(c).** Find the $x$- and $y$-intercepts $x$-int: (0,0) and (3,0), $y$-int: (0,0) **(d).** Sketch the graph and label 3 pts.

**7.** The percent of total work force that is female is given by $p(t) = -0.0034t^2 + 0.45t + 34$, where $t$ is the number of years past 1970. In what year is the percent of females in the workforce a maximum? What is that maximum persentage? vertex at $t \approx 66.18$, so in the year 2036 (nearly 2037) and the maximum percent is 48.89%

**8.** The monthly charge for water in a small town is given by $f(x) = \begin{cases} 62 & \text{if } 0 \le x \le 25 \\ 62 + 0.5(x - 25) & \text{if } x > 25 \end{cases}$ where $x$ is water usage in <u>*hundreds* of gallons</u> and $f(x)$ is in dollars.

**(a).** Find the monthly usage charge when the water usage is **(i)** 80 gallons **(ii)** 4000 gallons **(i)** \$62 **(ii)** \$69.50

**(b).** Graph the function for $0 \le x \le 100$.

**9.** Solve the following inequalities. Write your answers in interval notation and graph it on the number line.

**(a).** $2x + 1 > 4$ $(\frac{3}{2}, \infty)$ **(b).** $2(7x - 3) \le 12x + 16$ $(-\infty, 11]$

**10.** Solve the following inequality. Graph the solution on the number line. $x^2 - x - 6 \le 0$ $[-2, 3]$

**11.** Given the system of inequalities $\begin{cases} x+4y \geq 10 \\ 2x+6y \geq 18 \\ x \geq 0 \\ y \geq 0 \end{cases}$

**(a).** Shade the feasible region

**(b).** Find the corners $(0,3),(10,0),(6,1)$

**(c).** Minimize $f = 3x + 2y$ subject to the same constraints Minimum of 6 at $(0,3)$.

**12.** Solve the following inequalities. Graph the solution on the number line.

**(a).** $x^2 - x - 6 \leq 0$ $[-2,3]$

**(b).** $\dfrac{(x-3)^2}{(x+1)(x+2)} \geq 0$ $(-\infty,-2)\cup(-1,\infty)$

**13.** **(a).** Write in exponential form: $\log_3 81 = 4$ $3^4 = 81$

**(b).** Write in logarithmic form: $8^{1/3} = 2$ $\log_8 2 = \frac{1}{3}$

**14.** Graph the following functions(without a calculator) and clearly label 2 points.

**(a).** $y = 2e^x$ **(b).** $y = 3^{-x}$ **(c).** $y = \log_4 x$

**15.** Use properties of logarithms to expand the following logarithms as far as you can.

**(a).** $\log_2 x^3y^4 = 3\log_2 x + 4\log_2 y$

**(b).** $\log \frac{1}{\sqrt{A}} = -\frac{1}{2}\log A$

**(c).** $\log_b[P(1+r)^t] = \log_b P + t\log_b(1+r)$

**16.** Use properties of logarithms to combine the following into a single logarithm.

**(a).** $\log x^3 - 2\log y = \log \dfrac{x^3}{y^2}$

**(b).** $\log_2(x-1) + \log_2(x+1) - \dfrac{1}{2}\log_2 x = \log_2 \dfrac{x^2-1}{\sqrt{x}}$

**17.** Use the change of base formula to rewrite and/or evaluate the following.

**(a).** $\log_7 21 = \frac{\ln 21}{\ln 7} = 1.5645$ $OR$ $= \frac{\log 21}{\log 7} = 1.5645$

**(b).** $y = \log_2 x = \dfrac{\ln x}{\ln 2}$ $OR$ $= \dfrac{\log x}{\log 2}$

**18.** Solve the following equations for $x$.

**(a).** $3^{5x} = 81$ $x = \frac{4}{5}$

**(b).** $\log_9 x = \dfrac{1}{2}$ $x = 3$

**19.** After an advertising campaign, the monthly sales for stereos at a store is given by $S = 50,000(2)^{-0.85x}$ $S$ is the monthly sales (in dollars) and $x$ is the number of months that have passed since the end of the advertising.

**(a).** What is the monthly sales right at the end of the advertising? $S = 50,000(2)^{-0.85\cdot 0} = \$50,000.00$

**(b).** What is the monthly sales after 3 months? $S = 50,000(2)^{-0.85\cdot 3} = \$8537.75$

**20.** An initial amount of 15 g of radioactive iodine decays according to $A(t) = 15e^{-0.087t}$ where $t$ is given in days.

**(a).** How much is left after 2 days? $A(2) = 12.6$ g