Chapter 1 Quiz Key

1. Entomologists have discovered that a linear relationship exists between the number of chirps of crickets of a certain species and the air temperature. When the temperature is $70^\circ F$, the crickets chirp at the rate of 120 times/minute, and when the temperature is $80^\circ F$, they chirp at a rate of 160 times/minute. Let N denote the number of chirps per minute of the crickets and let T denote the temperature. Find a formula for N in terms of T and use the formula to predict the rate at which the crickets chirp when the temperature is $98^\circ F$.

$N(T) = m\cancel{x} + b$ $\quad (70, 120), (80, 160)$

$m = \dfrac{160-120}{80-70} = \dfrac{40}{10} = 4$

$\Rightarrow 120 = 4(\cancel{120}) + b$

$120 - 280 = b$

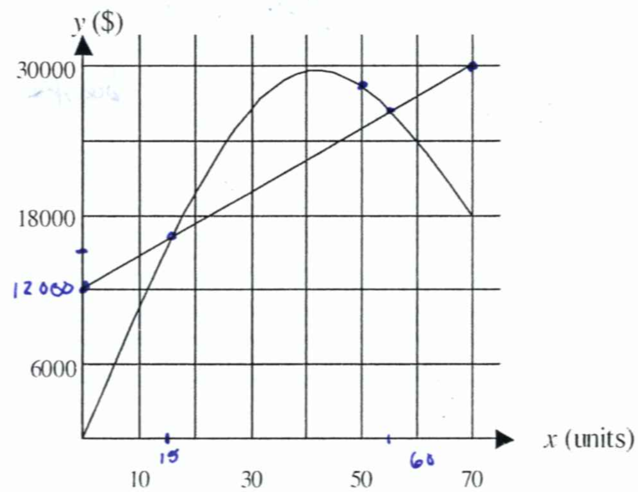
$b = -160$

$\therefore \boxed{N(T) = 4T - 160}$

Hence $N(98) = 4(98) - 160 = 232$

So when it's $98^\circ F$, the crickets chirp 232 times/min.

2. The graphs to the right are graphs of a cost function, $C(x)$, and a revenue function, $R(x)$, for $0 \le x \le 70$. (You must decide which graph goes with each function.) Use the graphs to answer the questions that follow. It is important that you estimate carefully.



a. What does the y-intercept of the graph of the cost function indicate?

fixed cost $x=0$

$C(x) = mx + b$

$C(0) = b \Rightarrow$ fixed cost.

b. Estimate the break-even production level(s).

$(16, 16000)$ and at $(55, 26,000)$

c. Calculate the profit earned at a production level of 50 units.

$\approx \$28,000$.

d. Give a formula for $C(x)$.

2pts - $(0, 12,000)$ and $(70, 30000)$

$m = \dfrac{30000 - 12000}{70 - 0} = \dfrac{18000}{70} = 257.14$

$C(x) = mx + b$

$= 257.14x + b$

$\therefore 12,000 = b$

$\boxed{C(x) = 257.14x + 12,000}$

3. Suppose that there is a linear relationship between demand for crude oil and the price of a barrel of crude oil. The daily demand for crude oil is 76.1 million barrels when the price is \$25.52 per barrel and this demand drops to 74.9 million barrels when the price rises to \$31.52. Let q denote the daily demand for crude oil, in millions of barrels, and let p denote the price of a barrel of crude.

a. Write an equation (the demand equation) that gives q in terms of p.

Two pts. on the line $(p, q(p))$ are $(25.52, 76.1)$ and $(31.52, 74.9)$

$q(p) = mp + b$

$m = \frac{74.9 - 76.1}{31.52 - 25.52} = \frac{-1.2}{6} = -.2 = -\frac{2}{10}$

$q(p) = -.2p + b$

$74.9 = -0.2(31.52) + b$

$b = 81.204$

$\therefore \boxed{q(p) = 81.2 - \frac{2}{10}p}$

b. Suppose that the daily supply of crude oil also varies with price according to the supply equation $q = 0.4p + 66.8$. What price (to the nearest penny) for a barrel of oil would result in a daily supply of 76.4 million barrels?

~~76.4 = 0.4p~~

Solve for p ... $q = 0.4p + 66.8 \Rightarrow 0.4p = q - 66.8$

$\Rightarrow p = \frac{10}{4}q - \frac{66.8}{0.4}$

$\therefore p = 2.5q - 167$

thus:

$p = 2.5(76.4) - 167$

$= \boxed{\$24 / \text{barrel}}$

c. If the price of a barrel of oil is \$30, is there a daily surplus of oil or a shortage of oil? Explain.

The

4. The table below gives data for the demand curve for a certain product, where p is the price of the product and q is the quantity sold every month at that price.

p (dollars)	8	10	12	14	16
q (tons)	320	290	260	230	200

Assume that the demand curve is a line. Find formulas for each of the following functions and interpret each of the slopes in terms of price and demand.

a. q as a function of p

$(8, 320)$, $(12, 260)$

$q(p) = mp + b$

$m = \frac{320 - 260}{8 - 12} = \frac{60}{-4} = -15$

So $320 = -15(8) + b$

$b = 440$

$\therefore \boxed{q(p) = -15p + 440}$

b. p as a function of q

2 pts... just reversed...

$p(q) = mq + b$

I have $q = -15p + 440$, solve for p...

$\Rightarrow q - 440 = -15p \Rightarrow 440 - q = 15p$

$\Rightarrow p = 440/15 - q/15$

$\therefore \boxed{p(q) = \frac{440}{15} - q\frac{1}{15}}$