Math 122 Sections 011, 013 HW 1 Solns

1.1

1. (a) - IV
   (b) - II
   (c) - III
   (d) - "I ~~was~~ went on a run but slowed down as I got more tired."

4. (a) The equality $f(40) = 370$ means that in the year 2000, the concentration of carbon dioxide (CO_2) in the air was 370 parts per million (ppm)

   (b) The expression "$f(50)$" is the concentration of CO_2 in ppm in 2010.

8. $f(5) = 10 \cdot 5 - (5)^2$
   $= 50 - 25$
   $= \boxed{25}$

9. $f(5) = \boxed{3}$. Note: because we have no formula for this function, the answer is approximate

12. $y = f(x) = x^2 + 2$.
   (a) When $x = 0$, $y = f(0) = 0^2 + 2 = \boxed{2}$.
   (b) $f(3) = 3^2 + 2 = 9 + 2 = \boxed{11}$
   (c) To find the values of x that give a y-value of 11, we substitute $y = 11$ and solve for x:

$y = x^2 + 2$

$11 = x^2 + 2$

$9 = x^2$

$x = \pm\sqrt{9}$) Note: Taking the square root gives ~~two~~ two solutions.

$x = \pm 3$

So **both $x = -3$ and $x = 3$** give a y-value of 11. How would you interpret this statement graphically?

(d) To find x-values that give a y-value of 1, we substitute 1 for y:

$y = x^2 + 2$

$1 = x^2 + 2$

$-1 = x^2$

$x^2 = -1$;

No solution, because x^2 is always at least 0.

How would you interpret the fact that $x^2 \geq 0$ graphically?

No values of x lead to a y-value of -1.

23. (a) – III

(b) – The vertical ~~temperature~~ intercept represents the initial ~~value~~ temperature of the potato. Perhaps this is the room temperature (if the potato has been sitting out in the open.)

1.2

2 $3x + 2y = 8$

$2y = -3x + 8$

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

Slope: $-3/2$, y-intercept: 4

8. $m = \frac{\Delta y}{\Delta x} = \frac{5-(-1)}{4-2} = \frac{6}{2} = 3$

Use point-slope form; use $(x_0, y_0) = (4, 5)$

$y - y_0 = m(x - x_0)$

$y - 5 = 3(x - 4)$

$y - 5 = 3x - 12$

$y = 3x - 7$

10. (a) **l_2 and l_3** have the same slope, and **l_2 has the larger y-intercept.**

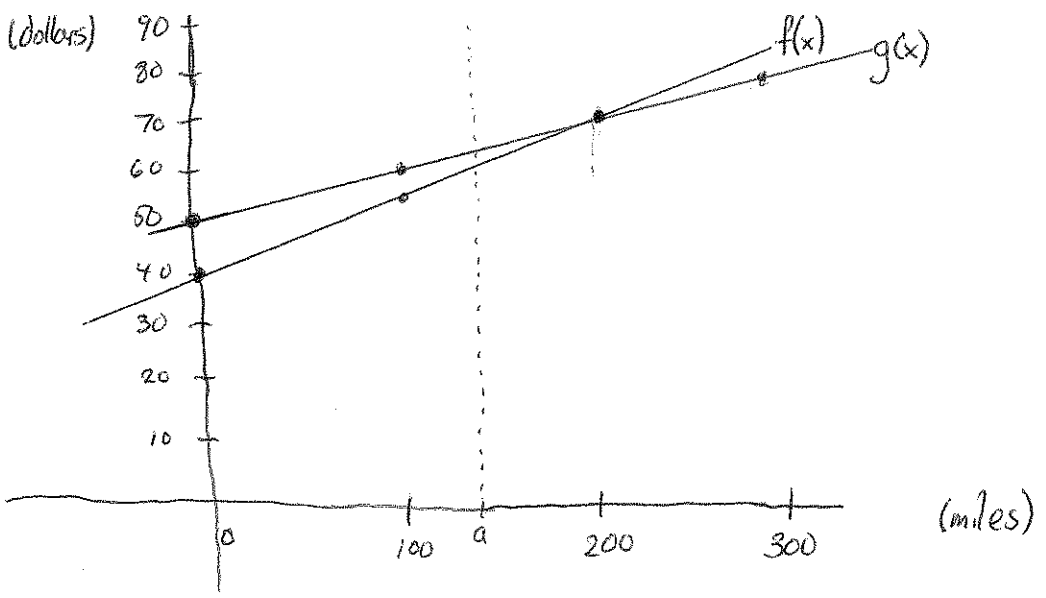
(b) **l_1 and l_3** have the same y-intercept, and **l_1 has the larger slope**

13. Let $f(x)$ be the cost (in dollars) of renting for one day at the first car company if the car is driven x miles. Let $g(x)$ be the cost of renting from the competitor.

(a) f: slope = 0.15, y-intercept = 40. **$f(x) = 0.15x + 40$**

g: slope = 0.1, y-intercept = 50. **$g(x) = 0.10x + 50$**

(6)



(4)

(c) To decide which company is cheaper, ~~look~~ first estimate how many miles (call it a) you will drive. Then look at ~~at the graph~~ the line in the graph where $x = a$.

~~If there~~ The cheaper company has a smaller corresponding y-value. In the example, $f(a) < g(a)$, so the first company is cheaper.

In general, looking at the graph shows that if ~~200 or~~ less than 2~~fewer~~ miles are driven, then the first company is cheaper. If more than 200 miles are driven, then the competitor is cheaper. If exactly 200 miles are driven, then the cost is the same.

17. (a) has a uniform average rate of change of -2 and could be linear.
(b) has a uniform average rate of change of 2 and could be linear.
(c) does not have a uniform average rate of change and is <u>not</u> linear.

19. (a) If q is a linear function of p:

$$m = \frac{\Delta q}{\Delta p} = \frac{4-3}{12-15} = \frac{1}{-3} = -\frac{1}{3}$$

- $q - q_0 = m(p - p_0)$, with $(p_0, q_0) = (15, 3)$

$$q - 3 = -\frac{1}{3}(p - 15)$$

$$q - 3 = -\frac{1}{3}p + 5$$

$$\boxed{q = -\frac{1}{3}p + 8}$$

(b) There are two ways to solve this once we have q as a function of p:

SAME METHOD AS BEFORE:

- $m = \frac{\Delta p}{\Delta q} = \frac{12-15}{4-3} = \frac{-3}{1} = -3$

- $p - p_0 = m(q - q_0)$ with $(q_0, p_0) = (3, 15)$

$$p - 15 = -3(q - 3)$$

$$p - 15 = -3q + 9$$

$$\boxed{p = -3q + 24}$$

ALTERNATE METHOD: Invert the formula (i.e. solve for p)

$$q = -\frac{1}{3}p + 8$$

$$3q = -p + 24$$

$$\boxed{p = -3q + 24}$$

23. (a) For each increase in the separation distance of 20 ft, the percent found drops by 10. Thus, the average rate of change is uniform.

(b) $m = \frac{\Delta P}{\Delta d} = \frac{80-90}{40-20} = \frac{-10}{20} = -\frac{1}{2}$

$P - P_0 = m(d - d_0)$ with $(d_0, P_0) = (20, 90)$

$P - 90 = -\frac{1}{2}(d - 20)$

$P - 90 = -\frac{1}{2}d + 10$

$\boxed{P = -\frac{1}{2}d + 100}$

(c) The slope is $\boxed{-\frac{1}{2} \text{ percentage points per foot.}}$ This means that for each additional foot between members of the search team, the number of lost hikers found is reduced by 0.5%.

(d) Vertical intercept or y-intercept: $d = 0$.

$P = -\frac{1}{2}d + 100$

$P = -\frac{1}{2} \cdot 0 + 100$

$P = \boxed{100\%}$. This means that if there is no distance between searchers, all lost hikers will be found.

Horizontal Intercept or x-intercept: $P = 0$

$0 = -\frac{1}{2}d + 100$

$\frac{1}{2}d = 100$

$d = \boxed{200 \text{ ft}}$

This means that if the searchers are 200 ft apart, then no lost hikers will be found.

32. age / MHR

- Avg rate of change in MHR from $t=0$ years to $t=21$ years:

$$\frac{\Delta MHR}{\Delta t} = \frac{-12}{21} \approx -0.571 \text{ (beats per minute) per year}$$

- Avg rate of change in MHR from $t=0$ years to $t=33$ years:

$$\frac{\Delta MHR}{\Delta t} = \frac{-19}{33} \approx -0.576 \text{ (beats per minute) per year}$$

Because -0.571 is ~~appro~~ close to -0.576, this is consistant with the MHR of females being linear

33. - Avg rate of change in MHR from $t=0$ to $t=21$:

$$\frac{\Delta MHR}{\Delta t} = \frac{-9}{21} \approx -0.429 \text{ (beats per min) per year}$$

- " " " " " " $t=0$ to $t=33$:

$$\frac{\Delta MHR}{\Delta t} = \frac{-26}{33} \approx -0.788 \text{ (beats per min) per year.}$$

Because -0.429 is not close to -0.788, this is not consistant with the MHR of males being linear.

1.3 1 - Concave down

2 - Concave up

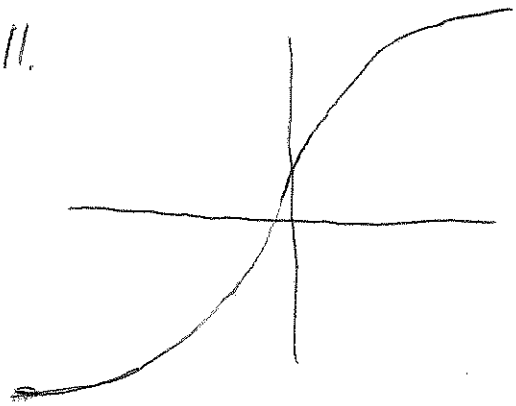
3 - Concave up

4 - neither

5. Rel Change $= \frac{450-400}{400} = \frac{50}{400} = \frac{5}{40} = \frac{1}{8} = 0.125 = \boxed{12.5\%}$

8. Rel Change $= \frac{0.05-0.3}{0.3} = \frac{-0.25}{0.3} = -\frac{25}{30} = -\frac{5}{6} \approx -0.833 = \boxed{-83.3\%}$

11.



← Many answers are possible.

12. Avg rate of change $= \frac{f(b)-f(a)}{b-a} = \frac{f(3)-f(1)}{3-1} = \frac{18-2}{2} = \boxed{8}$

15. (a) Change = 101 million − 11 million = **90 million bicycles**

(b) Avg Rate of change $= \frac{\Delta \text{Bicycles}}{\Delta \text{years}} = \frac{90 \text{ million bicycles}}{50 \text{ years}} =$ **1.8 million bicycles per year**

26. (a) The function is **increasing** and **concave down**.

(b) $\frac{f(15)-f(5)}{15-5} \approx \frac{125-70}{10} \approx \frac{55}{10} =$ **5.5 cm per year**

On average, the sturgeons grow 5.5 cm in length

38. The avg rate of change of F on small intervals decreases, so **F is concave down.**

- The avg rate of change of G on small intervals is uniform (i.e. stays the same), so **G is linear.**
- The avg rate of change of H on small intervals increases, so **H is concave up.**

41. See soln in back of book.