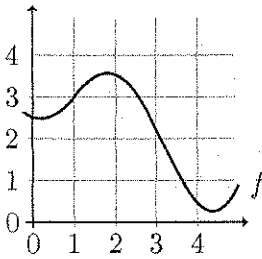


Name: Key

1. [2 points] Estimate the average rate of change of  $f$  from  $x = 1$  to  $x = 4$ . Show your work and simplify your answer.



$$\frac{f(4) - f(1)}{4 - 1} = \frac{\frac{1}{2} - 3}{3} = \frac{-\frac{5}{2}}{3} = \boxed{-\frac{5}{6}}$$

2. [2 parts, 1 point each] Classify each function as linear, concave up, or concave down. Circle one answer for each part.

(a) 

$t$	-2	0	2	3
$f(t)$	5	1	-3	-5

linear concave up concave down

(b) 

$x$	4	7	10	13
$g(x)$	12	16	22	30

linear concave up concave down

3. [3 parts, 1 point each] Susan and John need to travel from Columbia, SC to Chicago, IL, a distance of about 800 miles. Susan begins driving at time  $t = 0$  hours. John begins driving at time  $t = 1.5$  hours, and sets his cruise control to 68 miles per hour. When John begins driving, Susan has already traveled 90 miles. Both Susan and John travel at constant speed throughout the journey.

- (a) Give a linear formula for Susan's distance from Columbia at time  $t$ , for  $t \geq 0$ .

$$m = \frac{\Delta \text{output}}{\Delta \text{input}} = \frac{90}{1.5} = 60 \text{ mph}$$

$$\boxed{S(t) = 60t}$$

- (b) Give a linear formula for John's distance from Columbia at time  $t$ , for  $t \geq 1.5$ .

$$m = 68 \text{ mph}, (x_0, y_0) = (1.5, 0)$$

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

$$y - 0 = 68(x - 1.5)$$

$$y = 68x - \frac{3}{2} \cdot 68$$

$$= \boxed{68x - 102}$$

OR:

$$\boxed{J(t) = 68t - 102}$$

- (c) Will John pass Susan? If so, how far away from Columbia will John and Susan be when John passes? Give units and show your work.

• Find time where they meet.

$$S(t) = J(t)$$

$$60t = 68t - 102$$

$$102 = 8t$$

$$t = \frac{102}{8} = \frac{51}{4} \text{ hours}$$

• Find distance away from Columbia:

$$S\left(\frac{51}{4}\right) = 60 \cdot \frac{51}{4} = 15.51$$

$$= (10 + 5) \cdot 51$$

$$= 510 + 5 \cdot 51$$

$$= 510 + \frac{10}{2} \cdot 51$$

$$= 510 + 255 = 765$$

Yes, John passes Susan at a distance of 765 miles from Columbia