

Name: Key

1. [3 parts, 1 point each] The following table shows world bicycle production in millions.

Year	1950	1960	1970	1980	1990	2000
Bicycle Production	11	20	36	62	92	110

- (a) Find the average rate of change in bicycle production between 1960 and 1980. Include units.

$$\text{ARC} = \frac{62 - 20}{1980 - 1960} = \frac{42}{20} = \boxed{2.1 \text{ million bicycles/year}}$$

- (b) Find the relative change in bicycle production between 1980 and 1990.

$$\text{Rel Change} = \frac{92 - 62}{62} = \frac{30}{62} \approx \boxed{0.484 \text{ or } 48.4\%}$$

- (c) During which decade was the relative change in bicycle production the least?

In the 1990s, when the relative change was only about 19.6%.

2. [2 parts, 1 point each] A demand curve is given by  $15p + 60q = 240$ , where  $p$  is the price of the product in dollars and  $q$  is the quantity that the market demands at price  $p$ .

- (a) Find the  $p$ -intercept of the curve. Give units and interpret your answer in terms of consumer demand.

$p$ -intercept: set  $q=0$  and solve for  $p$ .

$$15p + 60 \cdot 0 = 240$$

$$15p = 240$$

$$p = \$16.$$

When the price is \$16, no one wants to buy the good.

- (b) Find the  $q$ -intercept of the curve. Give units and interpret your answer in terms of consumer demand.

$q$ -intercept: set  $p=0$  and solve for  $q$ .

$$15 \cdot 0 + 60q = 240$$

$$60q = 240$$

$$q = 4 \text{ units}$$

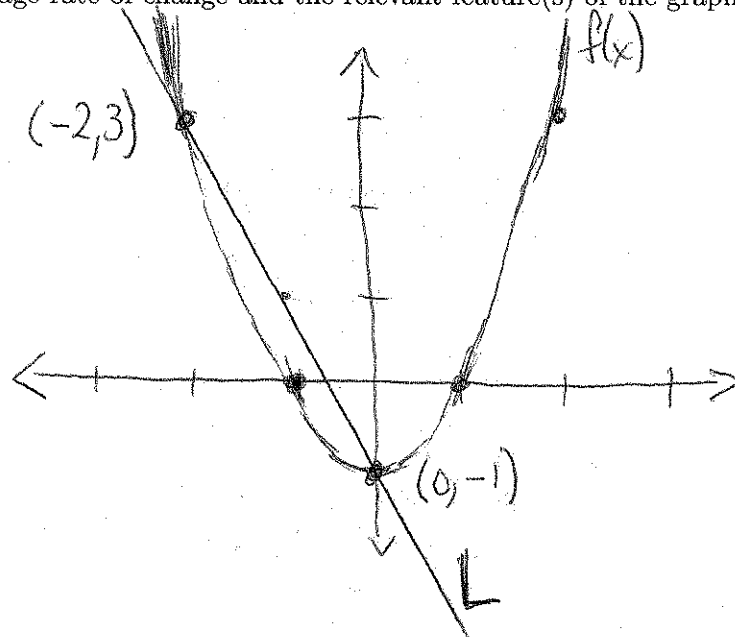
Even when the good is free, the consumers only want 4 units.

3. [2 parts, 1 point each] Average Rate of Change.

(a) Find the average rate of change of  $f(x) = x^2 - 1$  between  $x = -2$  and  $x = 0$ .

$$\text{ARC} = \frac{f(0) - f(-2)}{0 - (-2)} = \frac{(-1) - (4-1)}{2} = \frac{-1-3}{2} = \frac{-4}{2} = \boxed{-2}$$

(b) Illustrate your answer to part (a) graphically, clearly indicating the connection between the average rate of change and the relevant feature(s) of the graph.



The average rate of change is the slope of the secant line L.

4. [3 parts, 1 point each] A softdrink company pays \$3000 to maintain its equipment and spends \$0.25 to make each bottle. Bottles are sold in vending machines for \$1 each.

(a) Find formulas for the cost and revenue functions.

$$C(g) = 3000 + 0.25g$$

$$R(g) = 1 \cdot g$$

(b) Find the marginal cost and marginal revenue.

$$\text{Marginal cost} = \$0.25$$

$$\text{Marginal Revenue} = \$1.00$$

(c) Find the break-even point.

$$\begin{aligned} \text{Cost} &= \text{Revenue} \\ 3000 + 0.25g &= 1g \\ 3000 &= 0.75g \\ \frac{3}{4}g &= 3000 \end{aligned}$$

$$\begin{aligned} g &= \frac{4}{3} \cdot 3000 \\ g &= 4000 \end{aligned}$$

To break even, 4,000 bottles must be sold.