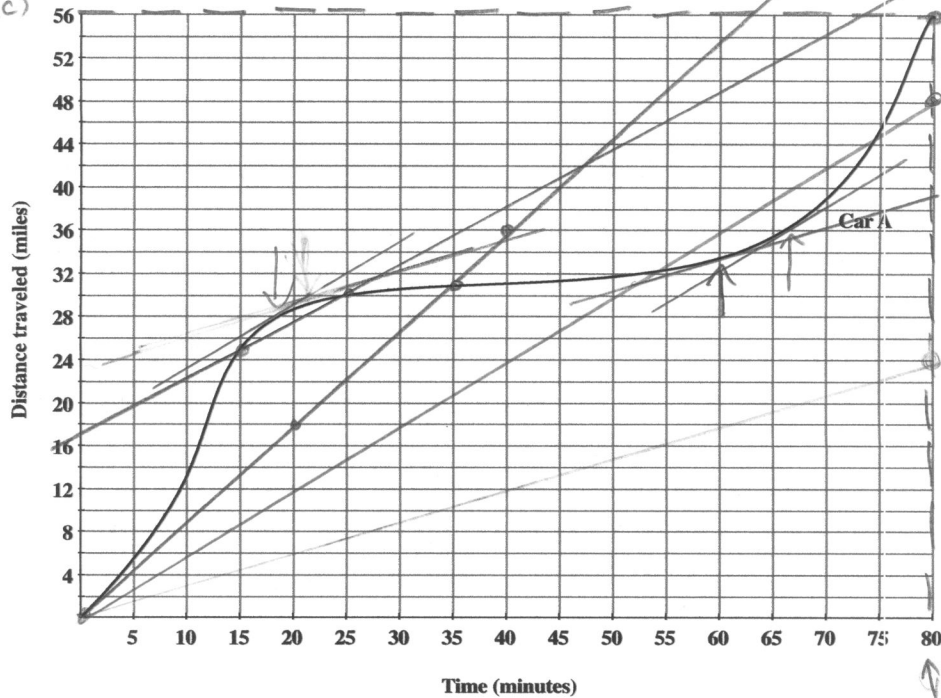VERSION 1

1. (12 pts) The graph gives total distance traveled vs time by a moving car, Car A.
   Let $A(t)$ represent the distance traveled by car A in t minutes.

PART (a)

PART (b)

PART (d)

PART (c)

PART (d)

Distance traveled (miles)

Car A

Time (minutes)

PART (e)

(a) Find a time at which Car A's average trip speed is 0.9 mpm.

SLOPE = 0.9
REFERENCE LINE

SLOPE FROM 0 to t = ?

(0,0) (10,9), (20,18),..., (40,36),...

$t = \underline{\quad 35 \quad}$ minutes

(b) Translate the following phrase into functional notation AND compute the value:
   Find the average speed of the car over the 10-minute interval starting at $t = 15$ minutes

2 POINTS : (5,20) (25,30)

SLOPE ≈ $\frac{30-20}{25-5} = \frac{10}{20} = 0.5$

FUNCTIONAL NOTATION: $\dfrac{A(25) - A(15)}{25 - 15}$

"Average speed from 15 to 25" = $\underline{\quad 0.5 \quad}$ mpm

(c) Find a value of t such that $A(t) - A(25) = 26$.

CHANGE IN HEIGHT FROM 25 to t = ? IS 26

$A(25) = 30 \Rightarrow A(t) - 30 = 26$

$A(t) \overset{?}{=} 56$

$t = \underline{\quad 80 \quad}$ minutes

(d) As accurately as possible, find the two one-minute intervals over which the car's average
   speed is ⬛ 0.6 mpm.

REFERENCE LINE

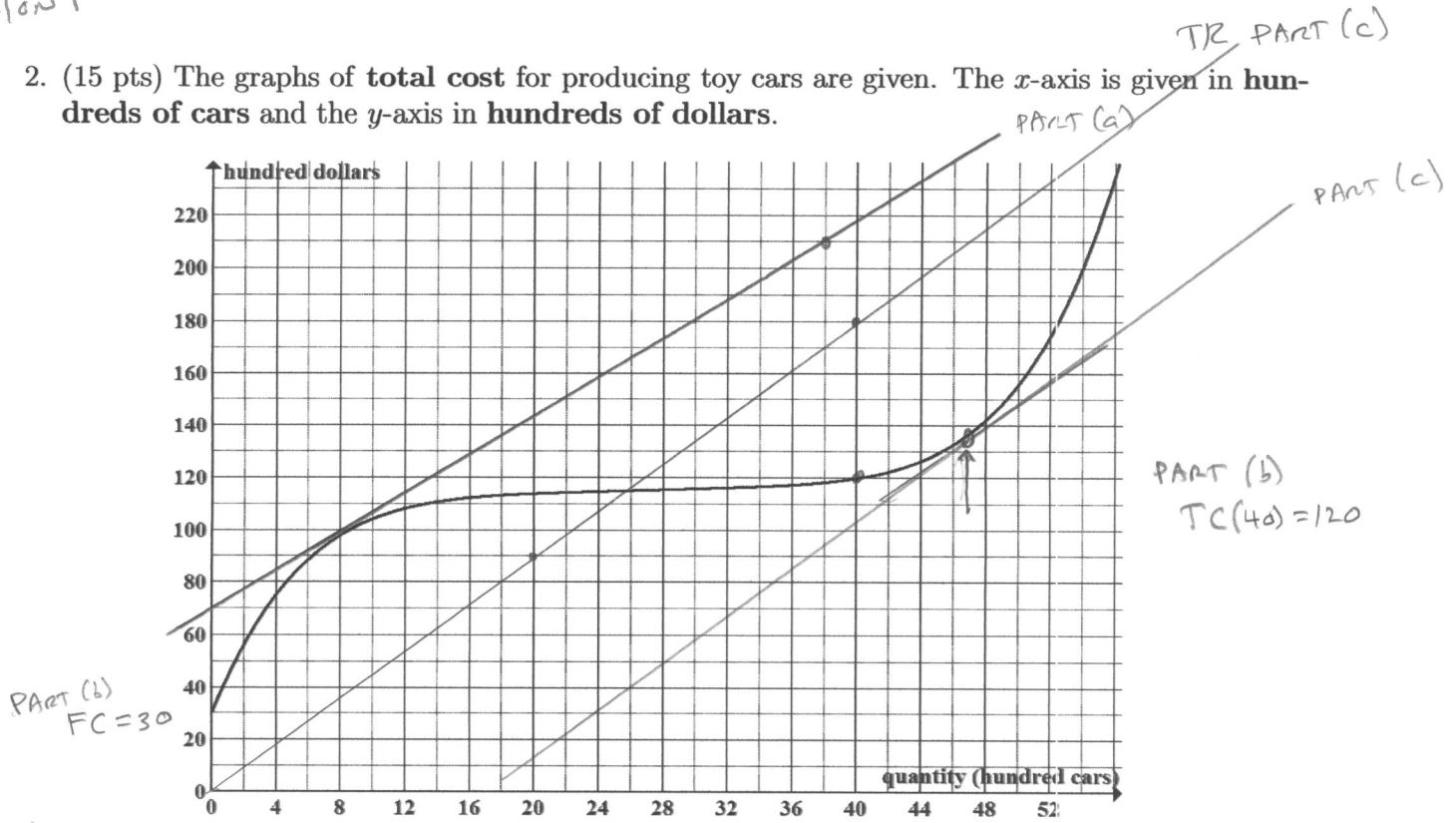(0,0) (10,6), ..., (50,30),.. (80,48)

One answer: $t = \underline{\quad 18 \quad}$ to $t = \underline{\quad 19 \quad}$ minutes

Another answer: $t = \underline{\quad 66 \quad}$ to $t = \underline{\quad 67 \quad}$ minutes

2. (15 pts) The graphs of **total cost** for producing toy cars are given. The x-axis is given in **hundreds of cars** and the y-axis in **hundreds of dollars**.

TR PART (c)

PART (a)

PART (c)

hundred dollars

PART (b)
TC(40) = 120

PART (b)
FC = 30

quantity (hundred cars)

(a) As accurately as possible, find the **marginal cost** at 800 cars

SLOPE OF TANGENT

2 POINTS: (0, 70), (38, 210)

$$\frac{210 - 70}{38 - 0} = \frac{140}{38} \approx 3.684$$

$MC(8) = $ ___ 3.68 ___ dollars per car

(b) Find the **average variable cost** at 4000 cars.

$AVC(40) = \frac{VC(40)}{40}$ → $AVC(40) = \frac{90}{40} = 2.25$

$TC(40) = 120$ AND $FC = 30$

SO $VC(40) = 90$

$AVC(40) = $ ___ 2.25 ___ dollars per car

(c) The market price is \$4.50 per car. Find the maximum profit (include units).

$TR(q) = 4.5q$ (0,0), ..., (20, 90), ... (40, 180)

MATCH SLOPES AT ABOUT $q = 47$

$TR(47) = 4.5(47) = 211.5 \approx 212$ PROFIT = 212 - 135 = 77

$TC(47) \approx 135$

Max Profit = ___ 77 ___ Units = ___ hundred dollars ___

(d) Identify which of the following are true and which are false (clearly circle your answers):

   i. TRUE or **FALSE**: From $q = 0$ to $q = 20$, $AC(q)$ is increasing.

   ii. **TRUE** or FALSE: From $q = 40$ to $q = 50$, $MC(q)$ is increasing.

   iii. TRUE or **FALSE**: The market price of 4.50 dollars/car is below the Break Even Price (BEP).

3. '(8 pts) Your company produces items. To the right are the graphs of **marginal cost**, **average cost**, and **average variable cost** for producing items over the next month for your company. The quantities are in items and MC, AC, and AVC are in dollars per item.
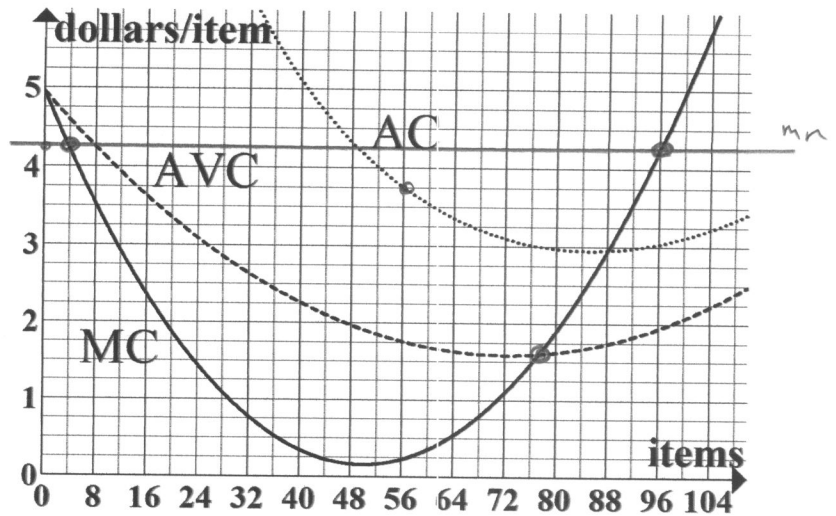
(a) Give the **total cost** at 56 items.

$$TC(56) = 56 \cdot AC(56)$$
$$= 56 \cdot 3.75 = 210$$

$TC(56) = $ _____ 210 _____ dollars

(b) If the market price for the month is \$1.25 per item should you STAY OPEN or CLOSE? (Briefly explain why. For full points you must make reference to the appropriate concept and graph value.) Explanation:

SDP ≈ 1.55
SINCE \$1.25 IS BELOW THE SHUTDOWN PRICE, YOU SHOULD CLOSE!
IT IS NOT POSSIBLE TO RECOVER ANY FIXED COST.

Circle one: STAY OPEN or (CLOSE.)

(c) Suppose the market price is \$4.25 per item. Give the longest interval over which profit is increasing. MR = 4.25

From $q = $ _____ 4 _____ to $q = $ _____ 96 _____ items

4. . (6 pts) Each dot in the graph to the right gives the **change in profit (in dollars) over the** <u>**next**</u> **thing** (also known as marginal profit). For example, the dot at (3,7) means that the profit goes up 7 dollars when you go from selling 3 things to 4 things.
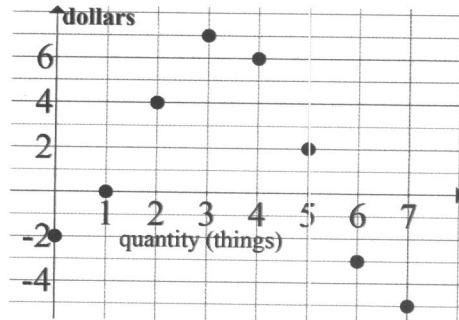
(a) Identify which of the following are true and which are false (clearly circle your answers):

   i. TRUE or (FALSE) The profit is higher at $q = 4$ than $q = 5$ things. 4 to 5 PROFIT GOES UP 6

   ii. (TRUE) or FALSE: The profit is higher at $q = 6$ than $q = 7$ things. 6 to 7 PROFIT GOES DOWN 3

(b) If the profit starts at -4 dollars when you sell zero things, then what is the profit if you sell $q = 4$ things? -4

0	-4) -2
1	-6) +0
2	-6) +4
3	-2) +7
4	5

Profit at $q = 4$ equals _____ 5 _____ dollars

5. (9 points) (Show your work)

(a) Consider the line $3x + 2y = 36$. Find the x-intercept and y-intercept of the line.

$x\text{-intercept} \Rightarrow y = 0 \Rightarrow 3x + 2(0) = 36 \Rightarrow x = \frac{36}{3} = 12$

$y\text{-intercept} \Rightarrow x = 0 \Rightarrow 3(0) + 2y = 36 \Rightarrow y = \frac{36}{2} = 18$

x-intercept: $(x, y) = \underline{\;(12, 0)\;}$

y-intercept: $(x, y) = \underline{\;(0, 18)\;}$

(b) Find the equation of the line that goes through $(1, 14)$ and $(6, 5)$.

$m = \frac{14 - 5}{1 - 6} = \frac{9}{-5} = -1.8$

$\boxed{y = -1.8(x - 6) + 5}$

$\boxed{y = -1.8(x - 1) + 14}$

$y = -1.8x + 1.8 + 14$

$\boxed{y = -1.8x + 15.8}$

ALL ACCEPTABLE

Equation for Line: $\boxed{y = -1.8x + 15.8}$

(c) For a certain product, the revenue is given by $TR(x) = \dfrac{7x}{2}$ and the total cost is given by $TC(x) = \dfrac{3x + 100}{5}$ where x is in **thousands items**.

For what values of x will there be a positive profit?

(Round all numbers in your final answer to the nearest item).

WANT $\quad TR > TC$

$\dfrac{7x}{2} > \dfrac{3x + 100}{5}$

$2 \cdot \Bigg($

$5 \cdot \Bigg($

$7x > 2 \cdot \dfrac{(3x + 100)}{5}$

$35x > 2 \cdot (3x + 100)$

$35x > 6x + 200$

$29x > 200$

$x > \dfrac{200}{29} \approx 6.89655$

NEAREST ITEM!

Answer: $\boxed{x > 6.897}$