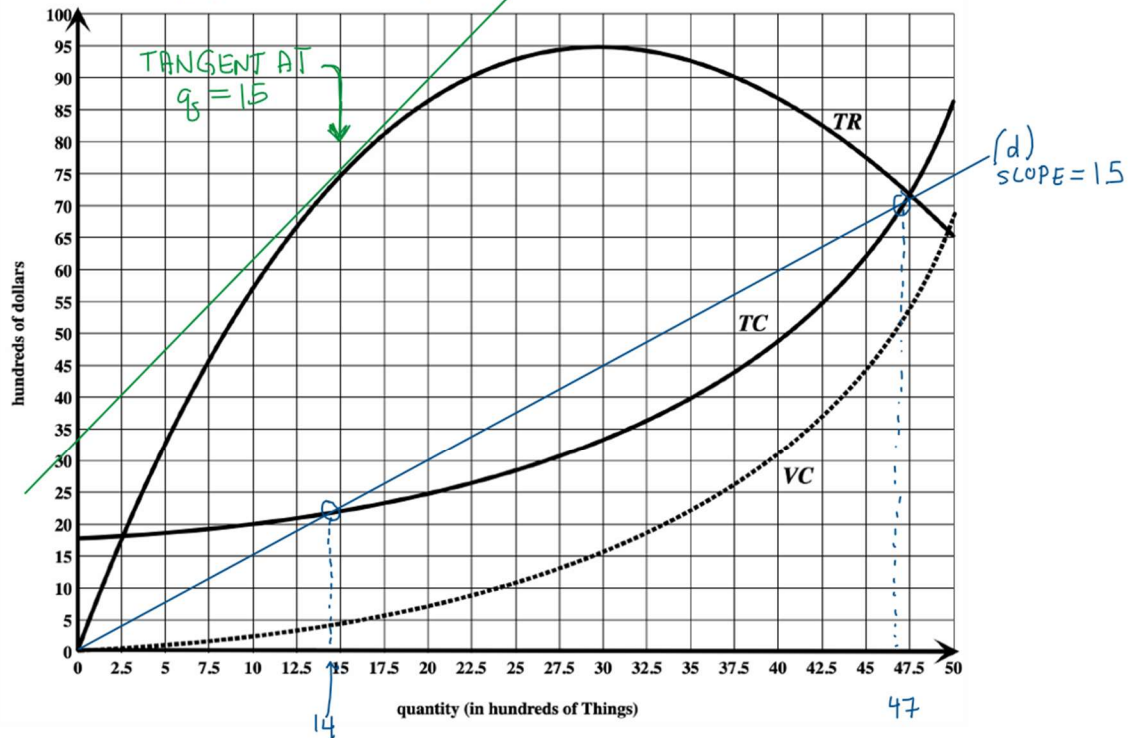1. (14 pts) The graph below shows total cost, variable cost, and total revenue (in hundreds of dollars) for producing and selling q hundred Things.

(handwritten annotations on graph: "(c)", "TANGENT AT $q_s = 15$", "TR", "(d) SLOPE = 15", "TC", "VC", "14", "47")

Show some calculations in every problem and label your work in the graph.

3 PTS (a) Find $TR(10) - TC(10)$.   ✓ PROFIT AT 10

$$\approx \underbrace{57}_{} - \underbrace{20}_{} = 37$$

ANSWER: ~ 37 _____ hundred dollars

3 PTS (b) Find the largest quantity at which profit is equal to zero.

TR = TC

AT $q \approx 2.6$ AND $q \approx 47.5$

ANSWER: ~ 47.5 _____ hundred Things

3 PTS (c) Estimate the marginal revenue at 15 hundred Things.

"TANGENT SLOPE AT $q = 15$"
DRAW TANGENT
2 PTS: $(2.5, 40)$ $(15, 75)$

SLOPE $\approx \dfrac{75 - 40}{15 - 2.5} = 2.8$

ANSWER: $MR(15) =$ _____ 2.^{80} _____ dollar per Thing

3 PTS (d) Find all quantities at which $\dfrac{TC(q)}{q}$ is equal to 1.50 dollars per Thing.
(If there is more than one, list all answers)

REFERENCE LINE WITH SLOPE 1.5

$(0,0)$ $(10, 15)$ $(20, 30)$, ...
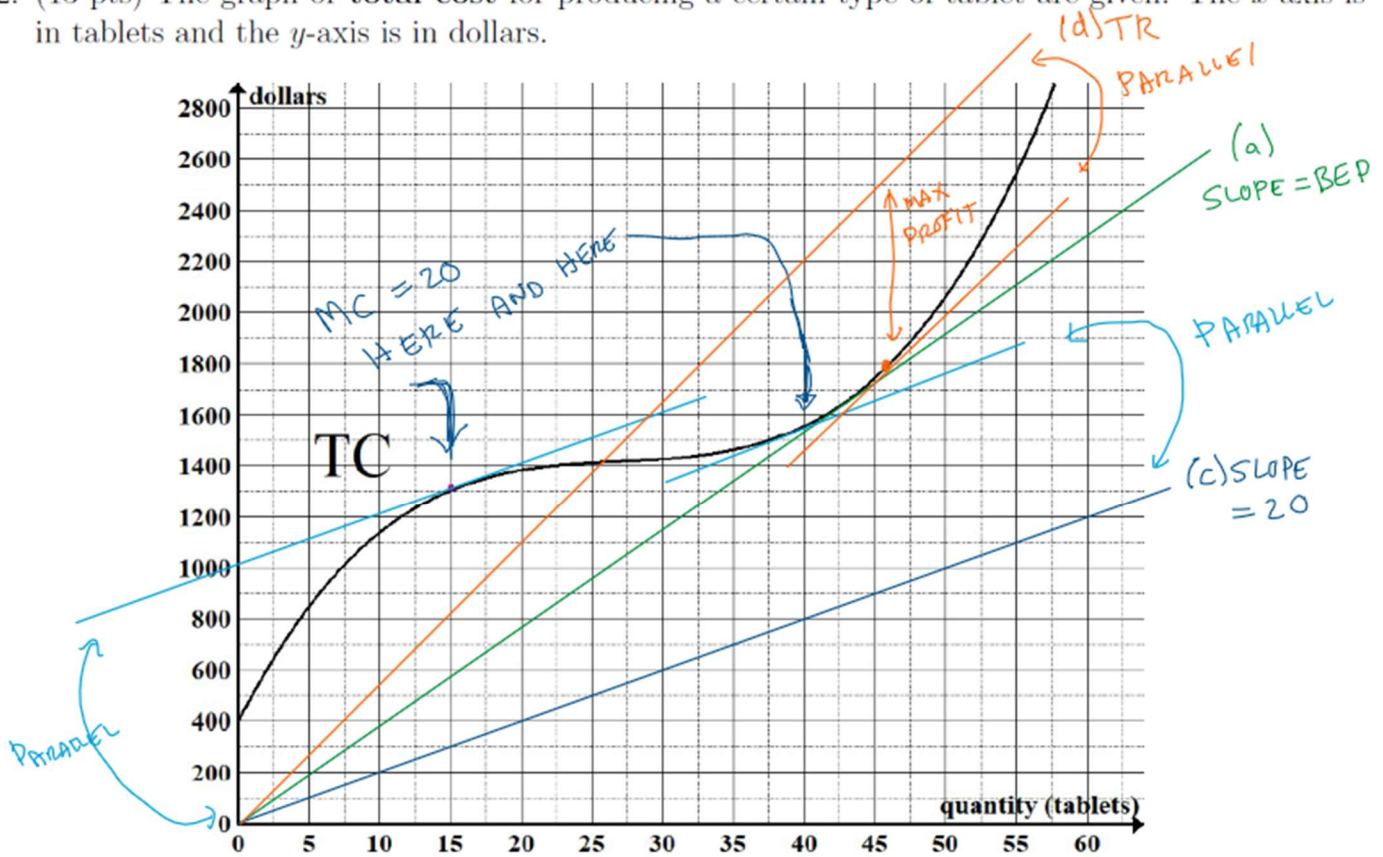
ANSWER $q =$ _____ 14 , 47 _____ hundred Things

2 PTS (e) Circle the **one** option that correctly completes the sentence:
On the interval from $q = 5$ to $q = 50$, the values of average cost..

(a) decrease and then increase   (c) are always decreasing
(b) increase and then decrease   (d) are always increasing

2. (13 pts) The graph of **total cost** for producing a certain type of tablet are given. The x-axis is in tablets and the y-axis is in dollars.

(d) TR

PARALLEL

(a) SLOPE = BEP

MAX PROFIT

PARALLEL

(c) SLOPE = 20

MC = 20 HERE AND HERE

TC

PARALLEL

Show some calculations in every problem and label your work in the graph.

3 (a) Find the Breakeven Price (BEP).

SLOPE OF LOWEST DIAGONAL LINE TO TC

2 PTS: $(0,0)$ $(62.5, 2400)$

$$\frac{2400 - 0}{62.5 - 0} = 38.\overline{40}$$

$BEP = \underline{\sim 38.\overline{40}}$ dollars per tablet

3 (b) Find the average variable cost at $q = 15$ tablets.

$AVC(15) = \dfrac{VC(15)}{15}$ $\longrightarrow$ $\dfrac{900}{15} = 60$

$TC(15) = 1300$ $\left.\begin{array}{l} \\ \end{array}\right\}$ SO $VC(15) = 900$
$FC = 400$

$AVC(15) = \underline{\sim 60}$ dollars per tablet

3 (c) Give the interval over which marginal cost is less than or equal to 20 dollars/tablet.

REF. LINE $(0,0)$, $(20, 400)$, $(40, 800)$

SLOPE OF TANGENT EQUALS 20 AT $q \approx 15$ AND $q \approx 40$

from $q = \underline{\sim 15}$ to $q = \underline{\sim 40}$ tablets

4 (d) Suppose the market price is \$55.00 per tablet. Find the quantity that maximizes profit and give the value of maximum profit.

REF. LINE $(0,0)$ $(40, 2200)$

MATCH SLOPES OF TR & TC

$TR(46) - TC(46)$
$\approx 2550 - 1800 = 750$

$q = \underline{\sim 46}$ tablets and Profit = $\underline{\sim 750}$ dollars

NOTE: Enlarged versions of the graphs on this page are given on the next page.

3. (5 pts)

[handwritten: 3]

The graph shows the **change in temperature**, in degrees Fahrenheit, every two hours beginning at midnight. Each dot on the graph represents the change in temperature over the *next* two hours.
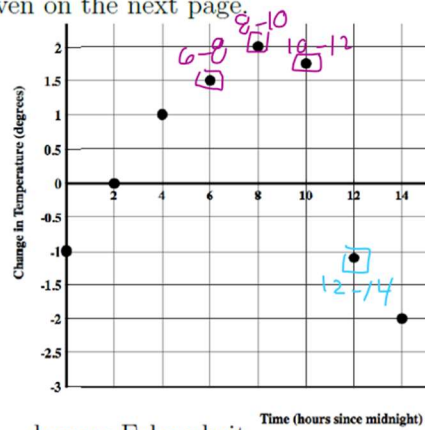
(a) If the temperature is 50 degrees at 6am, then what is temperature at noon?

[handwritten: $50 + 1.5 + 2 + 1.75$]

ANSWER: Temp at $t = 12$ equals _____ *[handwritten: ~55.25]* _____ degrees Fahrenheit

[graph with y-axis "Change in Temperature (degrees)" from -3 to 2, x-axis "Time (hours since midnight)" from 0 to 14, with handwritten annotations: 6-8, 8-10, 10-12, 12-14]

(b) Is the temperature at $t = 12$ higher or lower than the temperature at $t = 14$? And by how much?

[handwritten: $\frac{12 \mid 14}{}$]

[handwritten: TEMP HERE WILL BE HIGHER ~1.1]

CIRCLE ONE: (HIGHER) or LOWER by _____ *[handwritten: ~1.1]* _____ degrees Fahrenheit

[handwritten: 2]

---

4. (8 pts)

The graphs of **marginal cost**, **average cost**, and **average variable cost** for producing toy cars are given. The quantities are in hundreds of cars and MC, AC, and AVC are in dollars per item.

[graph: y-axis "dollars/car" 0 to 5, x-axis "quantity (hundred cars)" 0 to 48, curves labeled AC, AVC, MC]

(a) Give the Breakeven Price.

[handwritten: 2]

[handwritten: y-VALUE WHERE MC=AC]

[handwritten: ~2.80]
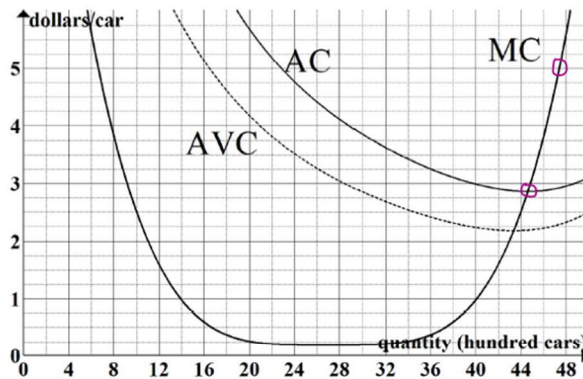
$BEP = $ _____ *[handwritten: ~2.80]* _____ dollars/item

(b) The current selling price is $5.00 per item. What *quantity* maximizes profit?

[handwritten: 3]

[handwritten: MR = 5]

[handwritten: MC = 5 WHEN $q \approx 47.5$]

_____ *[handwritten: ~47.5]* _____ hundred toy cars

(c) Use the graph and our business definitions to compute the total cost at $q = 24$, the variable cost at $q = 24$ hundred cars and the fixed costs.

[handwritten: 3]

[handwritten: $AC(24) \approx 4.75 \Rightarrow TC(24) = 4.75 \times 24 = 114$]

[handwritten: $AVC(24) \approx 3.50 \Rightarrow VC(24) = 3.50 \times 24 = 84$]

$TC(24) = $ _____ *[handwritten: ~114]* _____ hundred dollars
$VC(24) = $ _____ *[handwritten: ~84]* _____ hundred dollars
$FC = $ _____ *[handwritten: ~30]* _____ hundred dollars

[handwritten: DIFFERENCE]