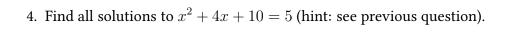
## Quiz 1

## Fundamentals of Calculus I

Name:
Explain and justify your thought process. Write your answers in the space provided.
1. What's the equation of the line going through $(2,5)$ and $(3,10)$ ?
2. For $f(x) = 1x + 5$ and $g(x) = 3x + 10$ , find all solutions to $3x = g(f(x))$ .

3. Graph  $x^2 + 4x + 10$ .



For questions 5 and 6, note Apple can build an iphone 6 factory for \$100,000. Each iphone costs \$100 to produce.

5. What's the total cost of producing 800 iphones?

6. If Apple sells each iphone for \$500, how many iphones does Apple need to sell to earn \$80,000 in profit?

## **Solutions**

1. What's the equation of the line going through (2,5) and (3,10)?

First we find the slope. Slope answers the question: how much does y change by when x increases by 1?

When x increases by 1, y increases from 5 to 10, implying the slope is 5. Therefore we have  $y = 5x + b \implies 5 = 10 + b \implies b = -5$ . Thus the equation of the line is y = 5x - 5.

2. For f(x) = 1x + 5 and g(x) = 3x + 10, find all solutions to 3x = g(f(x)). No solution, as the lines are parallel after evaluating the function:

$$g(f(x)) = 3(x+5) + 10$$
  
=  $3x + 15 + 10 = 3x + 25$ .

3. Graph  $x^2 + 4x + 10$ . Complete the square to understand the function:

$$x^2 + 4x + 10 = (x+2)^2 + 6$$

Therefore the function is  $x^2$  shifted to the left by 2 and up by 6.

4. Find all solutions to  $x^2 + 4x + 10 = 5$  (hint: see previous question). We determined the function is  $x^2$  shifted to the left by 2 and up by 6. Thus, the function never achieves a value of 5, meaning there are no solutions.

For questions 5 and 6, note Apple can build an iphone 6 factory for \$100,000. Each iphone costs \$100 to produce.

5. What's the total cost of producing 800 iphones?

if we let x be the number of iphones we have: cost = 100 x + 100,000 We evaluate our function at an input of 800: cost = 100\*800 + 100,000 = 80,000 + 100,000 = 180,000.

6. If Apple sells each iphone for \$500, how many iphones does Apple need to sell to earn 80,000 in profit? If x is the number of iphones sold,

$$profit = 500x - cost$$
  
=  $500x - (100x + 100,000)$   
=  $400x - 100,000$ .

We need to find the input (number of iphones sold) that generates an output (profit) of 80,000:

$$80,000 = 400x - 100,000 \implies 180,000/400 = x = 450.$$

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Therefore, Apple needs to sell 450 iphones to earn 80,000 in profit.

## **Common Mistakes**

- question 1: misreading the question. Many students provided only the slope, not the equation of the line.
- question 2: arriving at an impossible result 0 = 25, but not concluding the appropriate answer. We know 0 never equals 25. Therefore, the statements leading up to 0=25 can't be true either.
- misunderstanding what f(g(x)) notation means... (see question 2)