PLEASE REMEMBER: Show your reasoning and/or math work in every problem. Some questions have more than one part. Make sure you answer every part of the question that was asked. You are being asked to calculate some things and interpret others.

Section 1: These questions all involve mathematical reasoning with quadratic functions (at least in part) or polynomial functions. Recall that a quadratic function in standard form is $y = a \cdot x^2 + bx + c$ whose vertex is (h, k) and $h = \frac{-b}{2a}$, $k = a \cdot h^2 + b \cdot h + c$. A quadratic in "vertex form" is given by $y = a \cdot (x - h)^2 + k$.

1. (4 pts)

Let the **unit price** for a certain sneaker be given by: $P(x) = -0.85x + 250$, where x is the quantity of sneakers in demand and $P(x)$ is in dollars, that can be charged when x units are sold. For **cost**, suppose fixed costs of production for this item are \$400 and **unit costs** are \$10 per item produced. $[C(x) = fixed\ cost + unit\ cost \cdot x]$ If 106 items are produced and sold, find the following:

A) The total revenue from selling 106 items (to the nearest penny). (Recall that Revenue = Unit price * quantity sold)

Answer: $

B) The total costs to produce 106 items (to the nearest penny).

Answer: $

C) The total profits to produce 106 items (to the nearest penny).

Answer: $

D) How many items (x) need to be produced to **maximize** profit?

Answer: q = _____

2. (4 pts)

Consider the parabola (quadratic) given by the equation: $f(x) = x^2 - 2x - 8$
Find the following for this parabola:

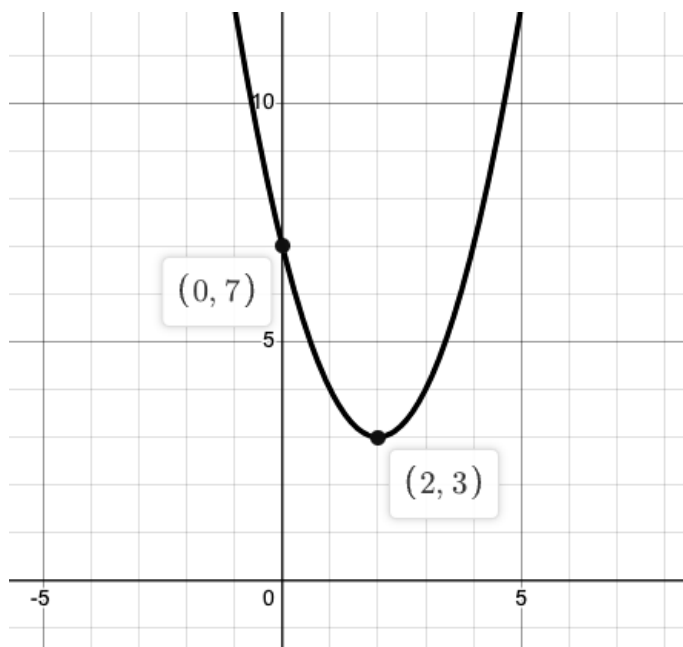A) The vertex: _____ Is it a maximum? Or minimum? _____

B) The vertical intercept (y-intercept) is the point _____

C) Calculate the y values for all values of x between -3 and 3. What does this tell you about the x-intercept(s)? Can you name them?
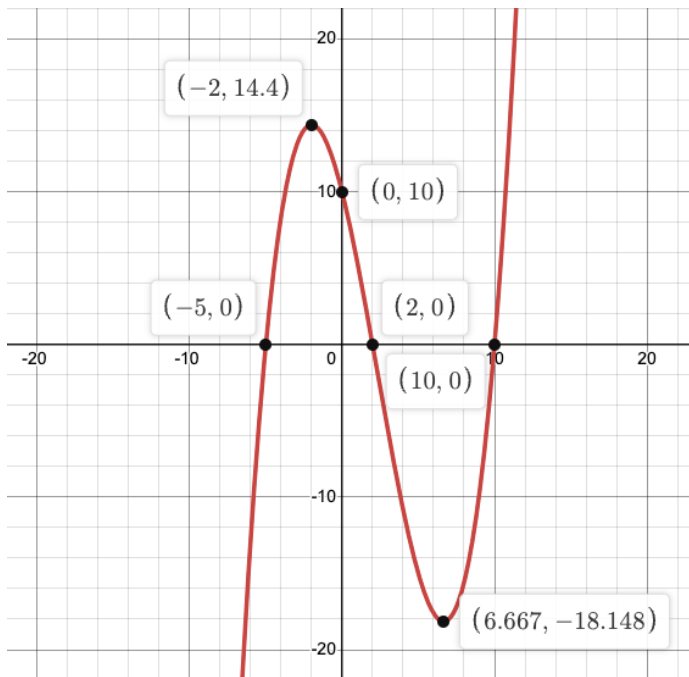
3. (4 pts)

Write an equation (any form) for the function graphed below:

f(x) = _____

4. (4 pts)

A polynomial function is shown on this graph.

Are there any extrema?

If so, name a point that represents a maximum (if any):

Name a point that represents a minimum (if any):

What is the y-intercept?

Are there any x-intercepts? If so, name it/them:

The graph shows the following labeled points: $(-2, 14.4)$, $(0, 10)$, $(-5, 0)$, $(2, 0)$, $(10, 0)$, $(6.667, -18.148)$.

Section 2: These questions all involve exponential or logarithmic growth or decay. Recall that an exponential function has the form $y = a \cdot b^x$ and logarithms are in base-10 $y = a \log(x - h)$ or using the "natural log" base-e $y = a \cdot \ln(x - h)$

5. (4 pts)

A vehicle purchased for $29,500 **depreciates** at a rate of 12% per year. Determine the approximate value of the vehicle 13 years after purchase. Round to the nearest whole dollar. If **P** is the price (value) of the vehicle, use the equation $P = P_0 * b^t$ and **b** = the decimal portion of the car's value in 1 year.

$_____

6. (4 pts)

Efforts to save the North Atlantic right whale have been underway since 2008 but the population **continues to decline**. What is known: deaths are caused by ship and boat strikes, and there is proposed legislation to make speed limits in migratory routes mandatory instead of voluntary, and that speed limits would apply to smaller-sized vessels known to have caused whale deaths. Cc: us.whales.org Suppose that, under these protections, the right whale population grows according to the function (t in years from now):
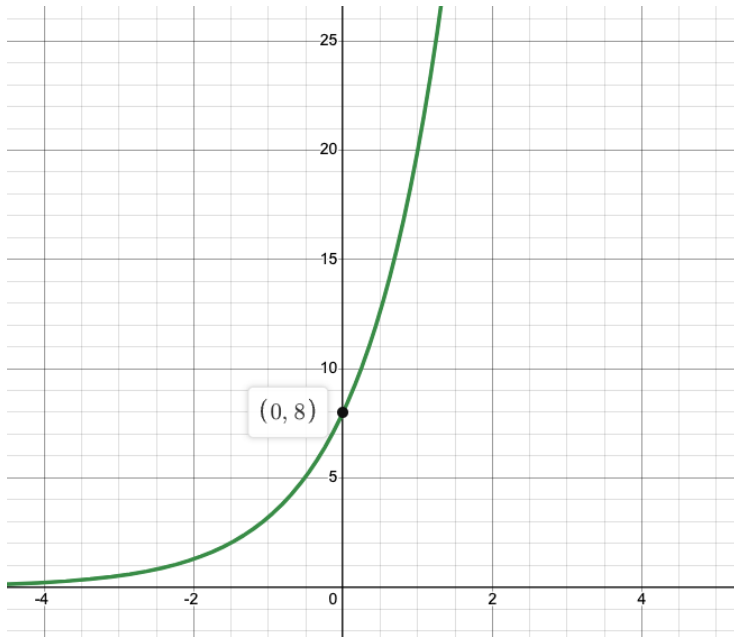
$W = 35 \cdot \log(t + 10) + 305$. (That is log base 10). Please answer the following questions:

    A. In how many years would the population reach 360? _____

    B. What is the population now? _____

    C. In 100 years' time, what will the population be? _____
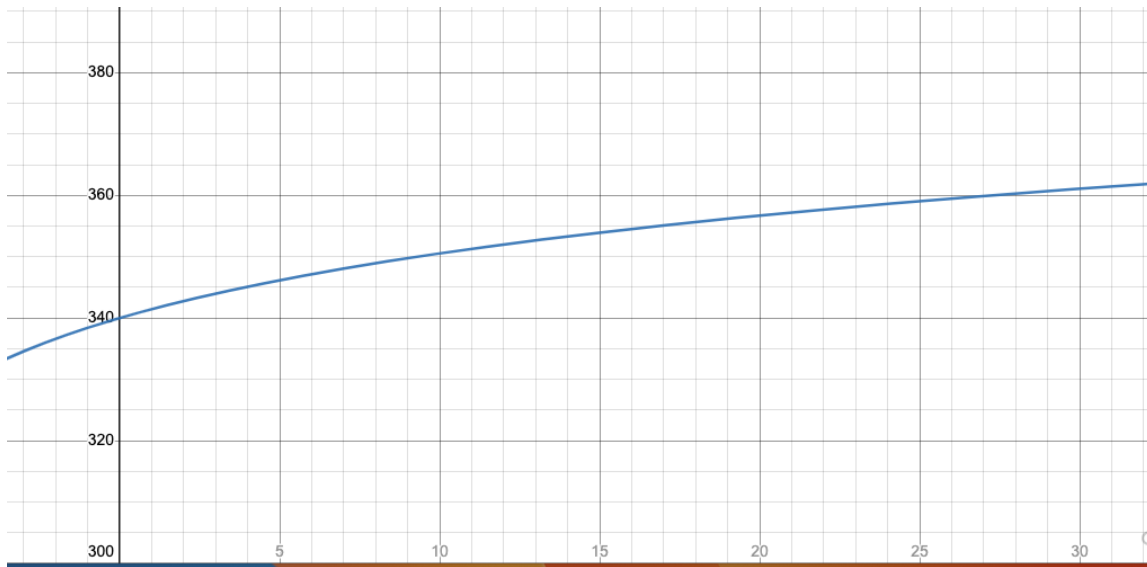
    D. What might explain the slow recovery? (This is open to opinion)

7. (4 pts)

Choose the equation that represents the graph shown here:

$$y = \frac{1}{2} \cdot 16^x$$

$$y = 8 \cdot 2.5^x$$

$$y = 8 \cdot 0.5^x$$

$$y = 4 \cdot 2^x$$

8. (4 pts) Please show your work!

An investment of 5,000 dollars is placed in an account for 25 years at an interest rate of 3.7% per year, **compounded continuously**. When the account is closed, 20% of the interest earned will be paid in taxes. What will the value be after taxes? Give your answer accurate to 2 decimal places. (Interest earned = Future value – Initial Value)

_____ years.

Section 3: These questions all concern financial situations that involve simple or compound interest. Please refer to your formula sheet, select the appropriate equation for each question, and calculate your answer. For partial credit, please write (show) here the exact calculation that you made.

9. (4 pts)

You can afford a $250 per month car payment. You've found a 4-year loan at 3% simple interest. How big of a loan can you afford? Note that the accumulated value (A) will be the total of all payments made. You are looking for the present value (P).

$_____

10. (4 pts)

You deposit $2000 in an account earning 4.2% interest compounded monthly. How much will you have in the account in 18 years?

$_____

11-12. (8 pts)

A young executive is going to purchase a vacation property for investment purposes. She will make a down-payment of $221,000.00 and purchase the property for $750,000.00. The market value is likely to increase by 2.8% compounded monthly. Her mortgage and maintenance cost will be $16,822.41 per month.

What is the amount she needed to mortgage? $_____

What will the value of the property be in 30 years? $_____

If we add the down-payment to the mortgage payments, what is the total cost of the property for the executive?

$_____

If she rents the property during the months of highest demand at $6,325 per week, what can she expect to make if every year it is booked for 17 weeks for 30 years?

$_____

Do you believe the property is worth the investment under these conditions? Why or why not?