**UNHM MATH 422 Exam #2** NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**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 whose vertex is and , . A quadratic in “vertex form” is given by .

**1. (4 pts)**

Let the **unit price** for a certain sneaker be given by: , where is the quantity of sneakers in demand and is in dollars, that can be charged when units are sold. For **cost**, suppose fixed costs of production for this item are and **unit costs** are per item produced. [ ] If items are produced and sold, find the following:  
  
A) The total revenue from selling items (to the nearest penny). (Recall that Revenue = Unit price \* quantity sold)

Answer: $   
  
B) The total costs to produce items (to the nearest penny).

Answer: $   
  
C) The total profits to produce items (to the nearest penny).

Answer: $

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

Answer: q = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**2. (4 pts)**

Consider the parabola (quadratic) given by the equation:   
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:

A picture containing white, day

Description automatically generated f(x) =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**4. (4 pts)**

Chart, line chart

Description automatically generatedA 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:

**Section 2:** These questions all involve exponential or logarithmic growth or decay. Recall that an exponential function has the form and logarithms are in base-10 or using the “natural log” base-*e*

**5. (4 pts)**

A vehicle purchased for $29,500 **depreciates** at a rate of 12% per year. Determine the approximate value of the vehicle years after purchase. Round to the nearest whole dollar. If ***P*** is the price (value) of the vehicle, use the equation and ***b*** = the decimal portion of the car’s value in 1 year.

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**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](https://us.whales.org/2022/07/29/federal-proposal-aims-to-protect-endangered-right-whales-from-ship-strikes/) Suppose that, under these protections, the right whale population grows according to the function (***t*** in years from now):

. (That is log base 10). Please answer the following questions:

1. In how many years would the population reach 360? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is the population now? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. In 100 years’ time, what will the population be? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Chart

Description automatically generated

1. What might explain the slow recovery? (This is open to opinion)

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**7. (4 pts)**

Choose the equation that represents the graph shown here:Chart, line chart

Description automatically generated

**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).  
  
$\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**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?