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Math 110 - Fall 2025 - Common Final Exam

Print name: Key

Section number:_____ **Instructor's name:**_____

Directions:

- **Do not open your exam until you are instructed to do so by your instructor.**
- Fill in your name, your instructor's name, and section number. If you don't know your section number, write the day and time that your class normally meets (example: MWF 8:15-9:05).
- This exam has 14 questions. Once the exam has begun, please check to make sure that your exam is complete.
- It will be graded out of 100 points.
- Show your work. Answers (even correct ones) without the corresponding work will receive no credit.
- A formula sheet has been provided with this exam. You may not refer to any other notes during the exam.
- You may use a calculator which does not allow internet access. The use of any notes or electronic devices other than a calculator is prohibited. Please remove any earbuds/headphones that you are wearing.
- **Unless otherwise stated, round any constants to two decimal places if necessary.**

Good luck!

Question:	1	2	3	4	5	6	7	8
Points:	8	8	6	8	6	6	9	5
Score:								

Question:	9	10	11	12	13	14		Total
Points:	8	6	9	8	10	3		100
Score:								

1. (8 points) Consider the function $f(x) = 2x^2 + 10x - 48$.

(a) Find the zeros of $f(x)$

$0 = 2(x^2 + 5x - 24)$

$0 = 2(x+8)(x-3)$

$x = -8, 3$

(b) Is $f(x)$ concave up, concave down, or neither? State why.

CCU $a = 2 > 0$

2. (8 points) For each part of this problem, circle **all** of the expressions which could be formulas for the function described. There could be more than one answer for each part.

(a) The function $f(x)$ has a domain of all real numbers

1. $3x + 5$
2. $4x^2$
3. $\ln(x-3)$
4. e^{3x}
5. $8x^5 - 4x^3 + 2x - 9$
6. $\sqrt{2x-4}$
7. $\dfrac{3}{x-5}$
8. None of these

1, 2, 4, 5

(b) The function $g(x)$ has a range of all real numbers

1. $3x + 5$
2. $4x^2$
3. $\ln(x-3)$
4. e^{3x}
5. $8x^5 - 4x^3 + 2x - 9$
6. $\sqrt{2x-4}$
7. $\dfrac{3}{x-5}$
8. None of these

1, 3, 5

3. (6 points) The point $(3, -5)$ is on the graph of $f(x)$. What point must be on the graph of...

(a) $g(x) = f(x-2)+4$

$(5, -1)$

(b) $h(x) = f(x+9)-2$

$(-6, -7)$

4. (8 points) The tuition for Fred University is dependent on the number of credit hours a student is taking in a given semester. If a student is taking less than 12 credit hours, the student must pay \$800 per credit hour along with an additional fee of \$5000. If a student is taking 12 or more credit hours, they must pay 600 per credit hour with along with an additional fee of \$4000. The university will not allow any student to take more than 24 credit hours in a semester, and a student must take at least one credit hour.

(a) Find a piece-wise formula for the tuition, T, for a student taking C credit hours.

$$T = \begin{cases} 800C + 5000 & 1 \le x < 12 \\ \text{6000} & \\ 600C + 4000 & 12 \le x \le 24 \end{cases}$$

(b) What is the domain of this function?

$1 \le x \le 24$

5. (6 points) The profits of a new company are directly proportional to the cube root of the amount of money that it spends on advertising. The profit of the company will be \$300 if they spend \$1000 on advertising.

(a) Write a formula for the profit, P, as a function of the amount spent on advertising, A.

$300 = K\sqrt[3]{1060}$

$300 = 10K$

$K = 30$

$P = 30 \cdot \sqrt[3]{A}$

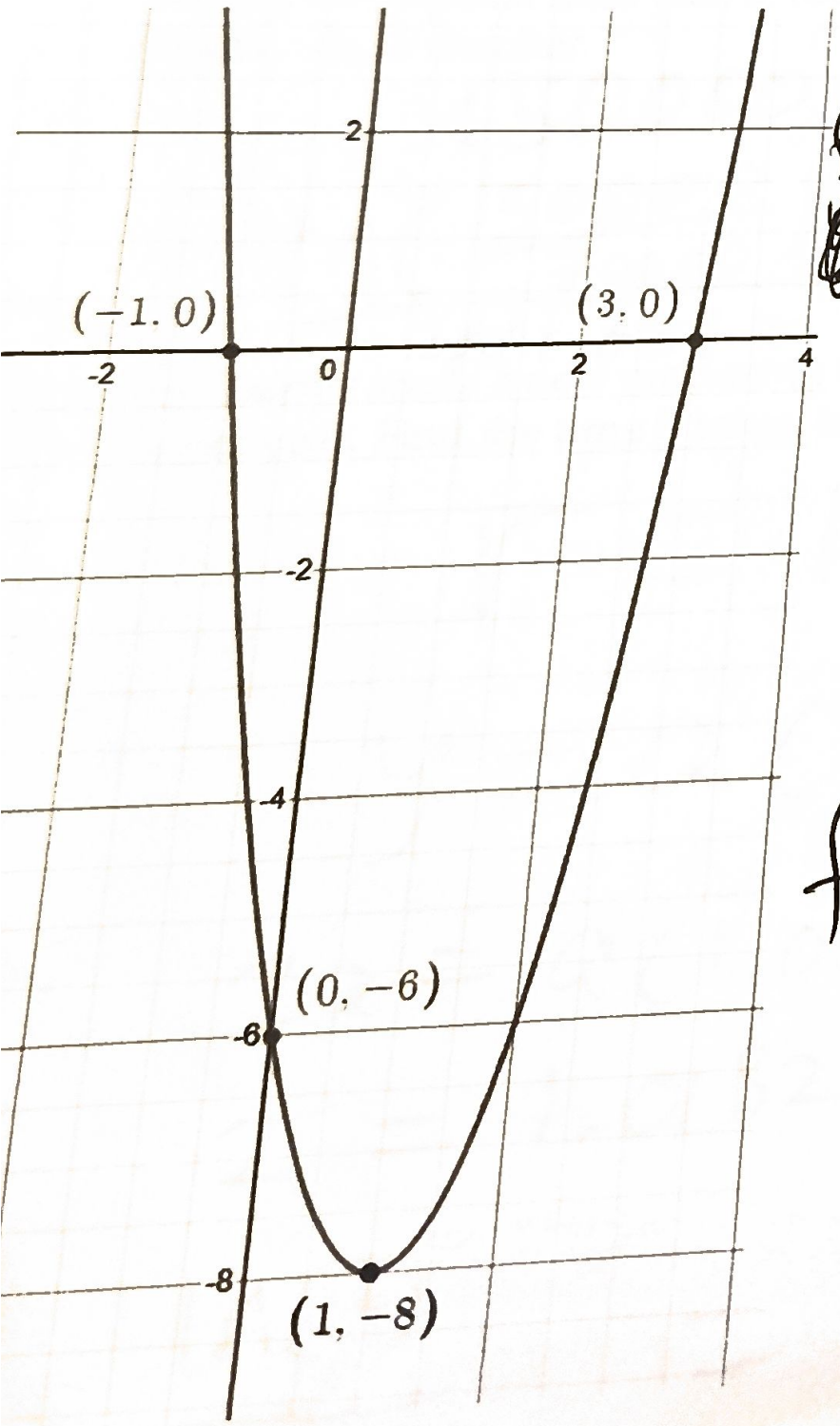
(b) Find the profit if \$125,000 is spent on advertising.

$P = 30 \cdot \sqrt[3]{125{,}000} = 30 \cdot 50$

$= 1500$

\$1500

. (6 points) Find the formula for the quadratic function $f(x)$ graphed below.



$f(x) = a(x+1)(x-3)$

$-6 = a(0+1)(0-3)$

$-6 = -3a$

$a = 2$

$f(x) = 2(x+1)(x-3)$

7. (9 points) The population of a town is 70,000 in the year 2025. Recall that a linear function has a general form of $P = mt + b$ and an exponential function has a general form of $P = a \cdot b^t$.

(a) If the population of the town is decreasing by 800 per year, find a formula for the function $P(t)$, the population t years after 2025.

$$P = -800t + 70000$$

(b) If the population is instead increasing by 3% per year, find a formula for the function $P(t)$, the population t years after 2025.

$$P(t) = 70000(1.03)^t$$

(c) Using your formula from part b, find the year the population will hit 150,000. Round to the nearest whole number.

$$150000 = 70000(1.03)^t$$

$$\frac{\ln\left(\frac{150000}{70000}\right)}{\ln(1.03)} = 25.784 \rightarrow 26$$

2051

5 points) Dariya starts a new marketing firm. The profits of her business are increasing at a rate f 1.82% per year. Find the time it takes, in years, for her profits to double.

$$r = 1.82\% = 0.0182$$

$$y = a(1.0182)^t$$

$$2a = a(1.0182)^t$$

$$2 = 1.0182^t$$

$$\frac{\ln(2)}{\ln(1.0182)} = t \approx 38.43 \text{ years}$$

9. (8 points) Determine if each function below is linear, exponential, or neither. Then, find a formula for the function or explain why it cannot be done.

(a)

x	1	3	5	7
$f(x)$	18	2	$\frac{2}{9}$	$\frac{2}{81}$

exp.

$2 = ab^3$

$18 = ab^1$

$\Rightarrow \frac{1}{9} = b^2 \Rightarrow b = \frac{1}{3}$

so, $18 = a(\frac{1}{3}) \Rightarrow a = 54$

$f(x) = 54 \cdot (\frac{1}{3})^x$

(b)

x	1	3	5	7
$f(x)$	4	12	-5	42

Neither. No constant slope or growth factor

(6 points) Jolena opens a bank account with an initial deposit of \$4,000. It earns interest at a nominal rate of 7% per year.

(a) Find the balance of their account after 6 years if interest is compounded as follows. Round each answer to the nearest dollar.

(i) Annually (once per year).

$4000(1.07)^6 = \$6003$

(ii) Daily (365 times per year).

$4000(1 + \frac{0.07}{365})^{365 \cdot 6}$

$= \$6088$

(9 points) Let $f(x) = 8x - 2$, $g(x) = -4x + 3$ and $h(x) = e^x$. Find the following, and simplify your answers completely:

(a) $g(f(5))$

$f(5) = 8(5) - 2 = 38$

$g(38) = -4(38) + 3 = -149$

(b) $h(f(x))$

$8x - 2$

e

(c) $f^{-1}(x)$

$y = 8x - 2$

$x = 8y - 2$

$x + 2 = 8y$

$y = \frac{x+2}{8}$

$f^{-1}(x) = \frac{x+2}{8}$

2. (8 points) Consider the exponential function $Q = 10e^{-0.28t}$. Let t be measured in years.

7 (a) Determine if this function displays ~~exponential growth~~ or decay.

Circle one: **exponential growth** or **exponential decay**. Explain your answer in a sentence.

$K = -0,28 < 0.$

(b) Give the initial value for this function.

10

(c) Give the continuous growth rate for this function. Write your answer as a percentage.

-28%

(d) Write the given function in the form $Q = ab^t$.

$Q = 10(0,76)^t$

(e) Find the percentage the function increases/decreases by per year. If the quantity is decreasing, write your percentage as a negative percentage.

-24%

13. (10 points) Assume $R = f(t) = 1200(1.82)^t$ is the revenue, in thousands of dollars, of a business t years after 2025.

(a) Evaluate $f(6)$. Round to the nearest whole number.

2

$1200(1.82)^6 = 43612$

(b) Describe in words what the quantity you calculated in part (a) represents. Write your answer in a complete sentence with units.

Revenue in 2031 is $43,612,000

or, 6 years after 2025, the revenue is $43,612,000

(c) Find a formula for $f^{-1}(R)$ in terms of R. Give an exact answer.

$\frac{R}{1200} = 1.82^t$

$t = \frac{\ln(\frac{R}{1200})}{\ln(1.82)}$

(d) Evaluate $f^{-1}(20000)$. Round to the nearest whole number.

$t = \frac{\ln(\frac{20000}{1200})}{\ln(1.82)} = 4.698 \to 5$

(e) Describe in words what the quantity you found in part (d) represents. Write your answer in a complete sentence with units.

5 years after 2025

the revenue is $20,000,000

. (3 points) Give an example of something that you learned in your course that will be useful in your future career and/or everyday life.