



Department of Mathematics and Statistics

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Common final exam for Math 117, May 2nd, 2024.

YOUR NAME: _____

SECTION: _____

INSTRUCTOR: _____

Directions:

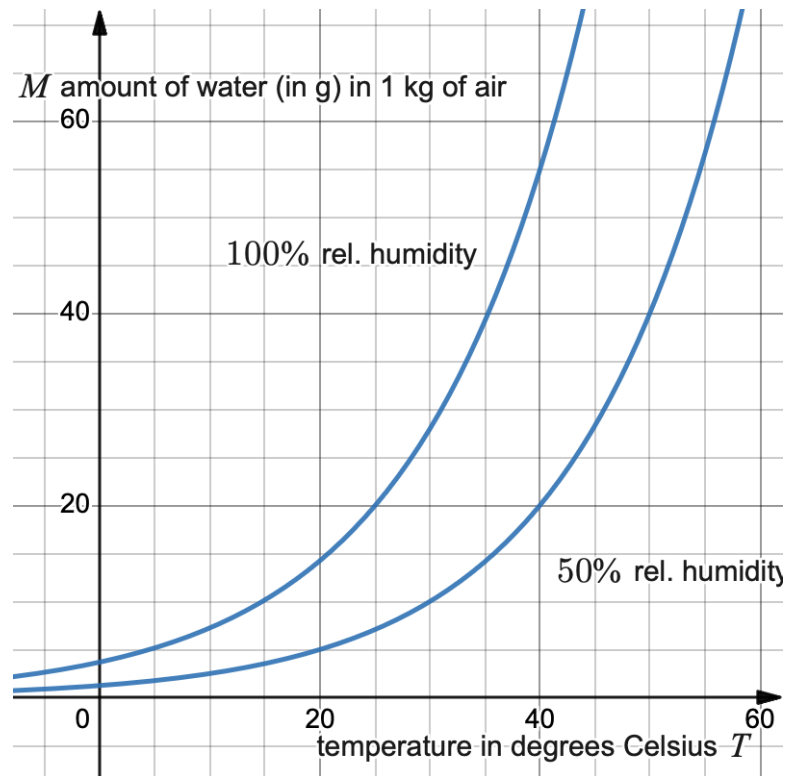
- Print your name, section number and your instructor's name on this page in the space provided.
- This exam has 15 questions. Please check that your exam is complete.
- You have two hours to complete this exam. It will be graded out of 120 points.
- Show your work. Answers (even correct ones) without the corresponding work will receive no credit.
- You may use a calculator and the list of equations attached at the end of the exam.
- When using decimals round your answers to three decimal places.
- You're not allowed to use notes, books, any internet resources, or electronic devices (except for a calculator).
- You may not communicate with anyone besides the instructor during this exam.

Problem	Score
1	/6
2	/12
3	/6
4	/8
5	/8
6	/6
7	/6
8	/8
9	/10
10	/8
11	/6
12	/8
13	/8
14	/10
15	/10
	/120

Good luck!

1. (Points: 6)

The figure below shows the mass of water in air, in grams of water per kilogram of air, as a function of air temperature in $^{\circ}\text{C}$, for two different levels of relative humidity.



- (a) Find the mass of water in 1 kg of air at 30°C if the relative humidity is 100%. Include units
- (b) How much water in grams is in a room containing 300 kg of air if the relative humidity is 50% and the temperature is 20°C ?

2. (Points: 12)

In a college meal plan you pay a membership fee; then all your meals are at a fixed price per meal.

(a) If 90 meals cost \$1005 and 140 meals cost \$1205, write a linear function that describes the cost of a meal plan, C , in terms of the number of meals, n .

(b) What is the cost per meal and what is the membership fee?

(c) Find the cost for 120 meals.

(d) Determine the maximum number of meals you can buy on a budget of \$1285.

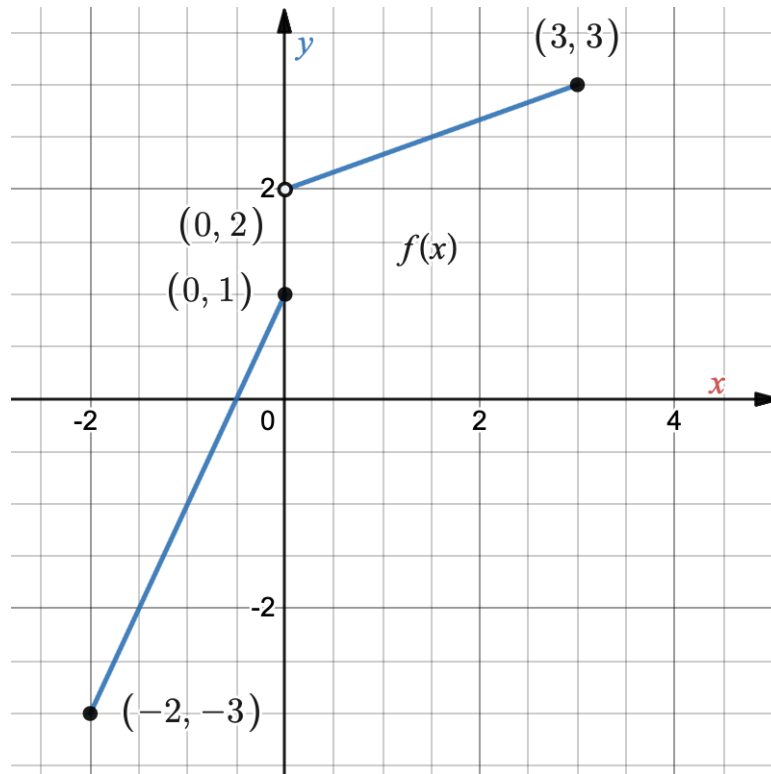
3. (Points: 6)

For the function $f(x)$ given below find the value of the inverse function $f^{-1}(3)$. Give the exact answer or round your answer till three decimal places.

$$f(x) = \frac{4x + 3}{2 - 5x}.$$

4. (Points: 8)

Use the graph of f below to answer the following questions.



(a) Fill in the blanks to give a piecewise-defined expression for f .

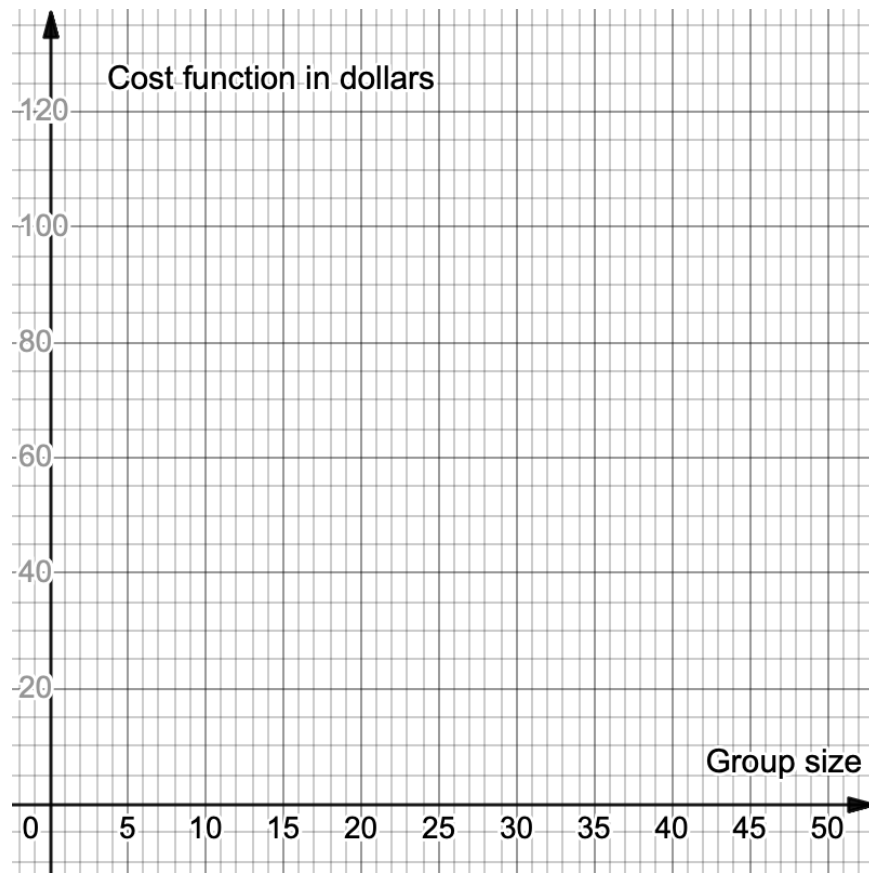
$$f(x) = \begin{cases} \underline{\hspace{2cm}}, & -2 \leq x \leq 0 \\ \underline{\hspace{2cm}}, & 0 < x \leq 3 \end{cases} . \quad (1)$$

(b) Give the domain and range of f .

5. (Points: 8)

A museum charges \$40 for a group of 10 or fewer people. A group of more than 10 people must, in addition to the \$40, pay \$2 per person for the number of people above 10. For example, a group of 12 pays \$44 and a group of 15 pays \$50. The maximum group size is 50.

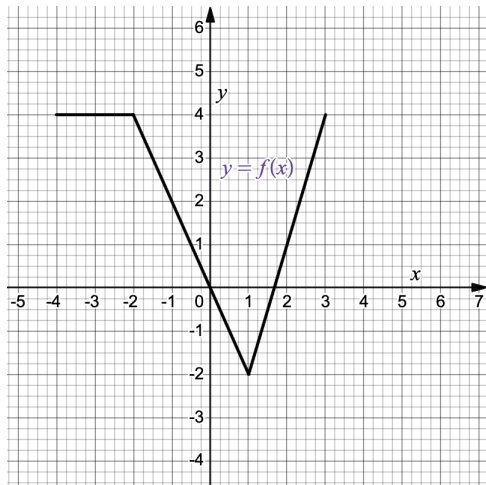
(a) Draw a graph that represents this situation.



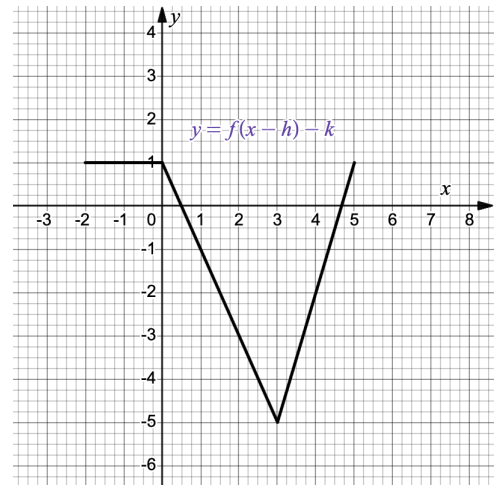
(b) What are the domain and range of the cost function?

6. (Points: 6)

The Figure (a) below shows the graph $y = f(x)$.



(a) Figure (a)



(b) Figure (b)

Find a formula in terms of f for the graph of the function in Figure (b). Your formula should be of the form $y = f(x - h) + k$ for appropriate constants h and k .

7. (Points: 6) Let, $C = C(F) = \frac{5}{9}(F - 32)$ where C is temperature in degrees Celsius and F is in degrees Fahrenheit. The temperature,

$$F = F(n) = 68 + \frac{10}{2 + n^2},$$

in degrees Fahrenheit of a room is a function of the number, n , of hours that the air conditioner has been running. Find $C(F(5))$. Round your answer to two decimal places and give appropriate units.

8. (Points: 8) The table below shows the concentration $C = f(t)$ (in millimoles per liter) of the chemical phenolphthalein in solution as a function of time t in seconds. By evaluating successive rates of change determine if f is concave up or concave down?

t sec	1.5	2.5	3.5	4.5
C	2.117	3.490	5.745	9.488

9. (Points: 10)

A ball is thrown into the air. Its height (in feet) t seconds later is given by

$$h(t) = 80t - 16t^2.$$

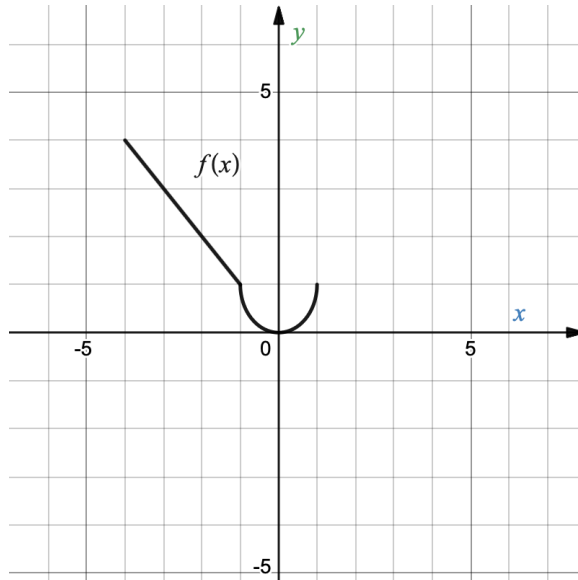
(a) Write the formula for $h(t)$ in the vertex form.

(b) Using the vertex formula determine the time required to reach the peak altitude from the ground.

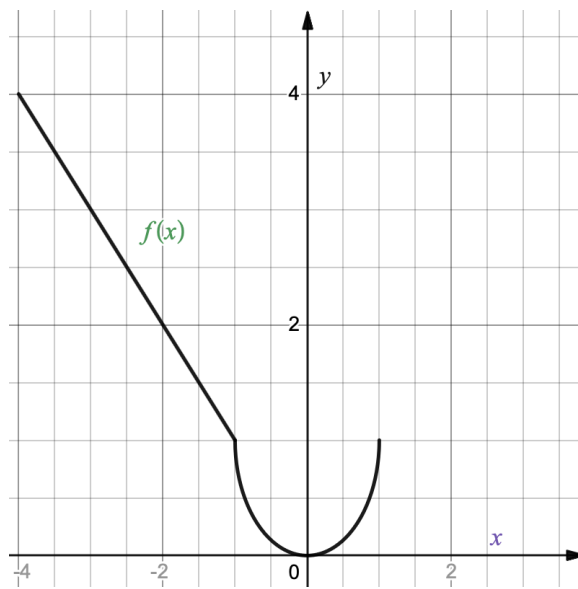
(c) Calculate the maximum height of the ball relative to the ground.

10. (Points: 8) Graph the following transformations of the function $f(x)$ on the same axes.

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



(b) $y = \frac{1}{2}f(2x)$



11. (Points: 6) The point $(6, -3)$ is on the graph of $g(x)$.

What point must be on the graph of the function $3g(x - 5) + 1$?

12. (Points: 8) The total cost $C(n)$ in dollars for a producer to manufacture n units of a good is given by

$$C(n) = 500 + 5n.$$

The average cost of producing n units is

$$a(n) = \frac{C(n)}{n}.$$

- (a) Evaluate and interpret the economic significance of $C(1000)$.

- (b) Evaluate:

i. $a(1000)$

ii. $a(10000)$

iii. $a(100000)$

- (c) Based on part (b), what trend do you notice in the values of $a(n)$ as n gets large? Explain this trend in economic terms.

13. (Points: 8)

For the rational function given below find all finding zeros, vertical and horizontal asymptotes.

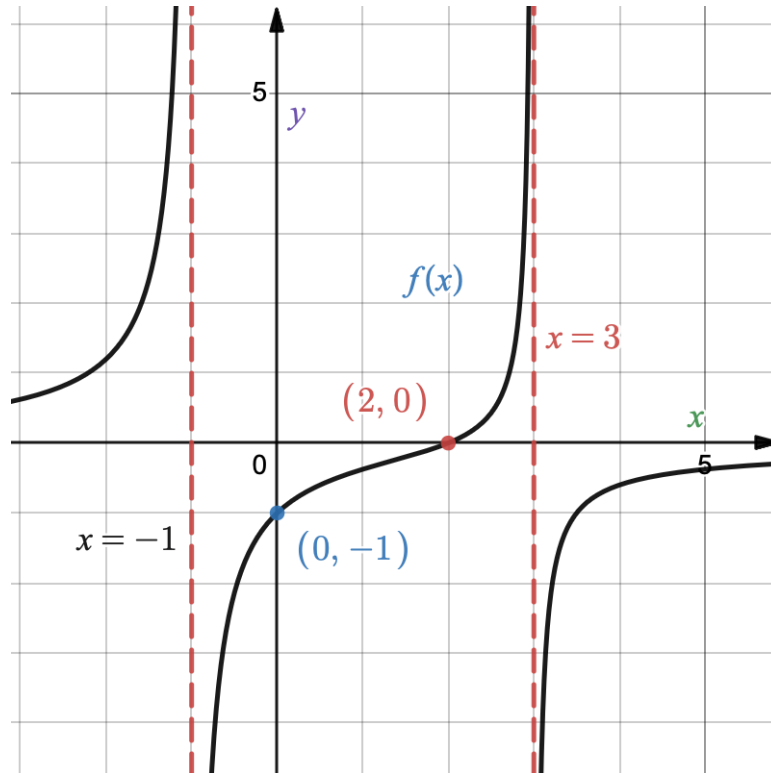
$$y = \frac{2x + 3}{x^2 - 2x - 3}$$

14. (Points: 10)

Find a possible formula for a fourth degree polynomial function $g(x)$ that has a double zero at $x = 4$ and $g(5) = 0$, $g(-1) = 0$ and $g(0) = 4$.

15. (Points: 10)

The function f is a rational function. Its graph is shown below. Give a possible formula for $f(x)$.



HAVE A NICE SUMMER!

Formulas

Average rate of change: $\frac{f(b) - f(a)}{b - a}$

Slope-intercept form: $y = b + mx$

Point-slope form: $y - y_0 = m(x - x_0)$

Standard form: $Ax + By = C$

Quadratic function: $y = ax^2 + bx + c$

Factored form: $y = a(x - r)(x - s)$

Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vertex form: $y = a(x - h)^2 + k$

Power function $y = kx^p$

Directly proportional: $y = kx$

Inversely proportional: $y = \frac{k}{x}$

Factored form of a polynomial: $p(x) = c(x - a_1)(x - a_2) \cdots (x - a_n)$