



Math 117 - Fall 2022 - Common Final Exam, version A

Print name: _____

Section number: _____ Instructor's name: _____

Directions:

- This exam has 12 questions. Please check that your exam is complete, but otherwise keep this page closed until the start of the exam is called.
- Fill in your name, and your instructor's name.
- Show your work. Answers (even correct ones) without the corresponding work will receive no credit.
- 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.

Good luck!

| | | | | | | | |
|-----------|---|---|----|----|----|---|-------|
| Question: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Points: | 6 | 8 | 12 | 6 | 10 | 8 | 8 |
| Score: | | | | | | | |
| Question: | 8 | 9 | 10 | 11 | 12 | | Total |
| Points: | 8 | 8 | 8 | 8 | 10 | | 100 |
| Score: | | | | | | | |

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: $p(x) = c(x - a_1)(x - a_2) \cdots (x - a_n)$

1. (6 points) Ten inches of snow is equivalent to one inch of rain. Write an equation for the amount of precipitation, measured in inches of rain, $r = f(s)$ as a function of the equivalent number of inches of snow s .

2. (8 points) Given the function $f(x) = 2 - x^2$, compute the average rate of change of f between $x = 1$ and $x = 4$. Show your work.

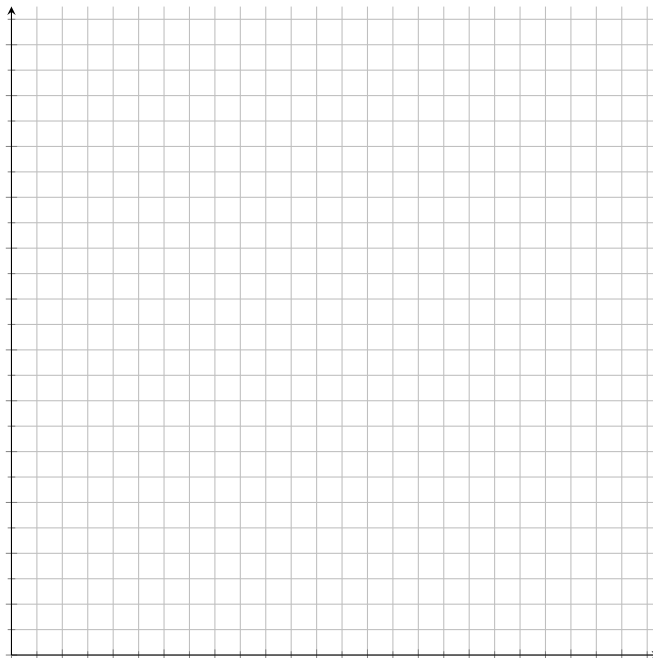
Exam continues...

3. We have \$24 to spend on vegetables and fruit. A pound of vegetables costs \$1 and a pound of fruit costs \$2. The number of pounds of vegetables we can afford, y , is a function of the number of pounds of fruit we buy, x .

(a) (6 points) Find an equation relating x and y .

(b) (6 points) On the axes below:

- Graph your equation.
- Label each axis by writing the name of the variable and its units along the axis.
- Label the coordinates at the vertical and horizontal intercepts.
- Draw a dot at the point on your graph corresponding to a purchase of 2 pounds of fruit and label its coordinates.



4. (6 points) Write the equation of the line perpendicular to $4x + 3y = 9$ that passes through the point $(8, 5)$.

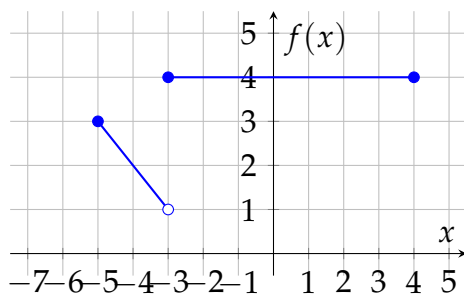
5. Let $f(x) = 2x - 7$ and $g(x) = \frac{2x - 3}{4x + 2}$.

(a) (3 points) Evaluate $g(3)$.

(b) (3 points) Evaluate $f(g(3))$.

(c) (4 points) Find all values of x solving $g(x) = 3$.

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



(a) (5 points) Fill in the blanks to give a piecewise-defined expression for f .

$$f(x) = \begin{cases} \underline{\hspace{4cm}} & \text{for } \underline{\hspace{4cm}} \\ \underline{\hspace{4cm}} & \text{for } \underline{\hspace{4cm}} \end{cases}$$

(b) (3 points) Give the domain and range of f .

- Domain: _____
- Range: _____

Exam continues...

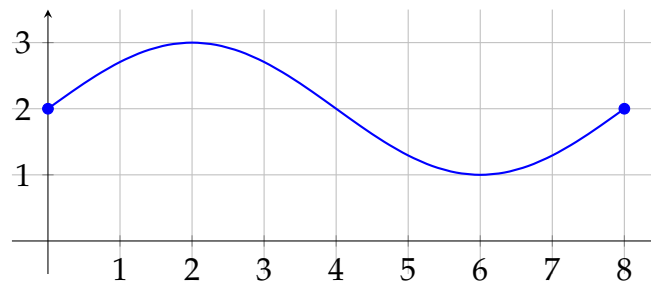
7. The cost (in dollars) of producing x dryers is

$$C = f(x) = 450 + 27x$$

(a) (5 points) Give an expression for $f^{-1}(C)$.

(b) (3 points) Explain in a sentence the practical meaning of your expression, with correct units.

8. (8 points) The graph of $y = f(x)$ is given below.



Give the intervals on which f is simultaneously ...

(a) ... increasing and concave up.

(b) ... increasing and concave down.

(c) ... decreasing and concave up.

(d) ... decreasing and concave down.

9. (8 points) The graph of $y = g(x)$ contains the point $(-6, 18)$. Find a point on the graph of each of the following transformations of g .

(a) $y = -2g(x)$

(a) _____

(b) $y = g(3x)$

(b) _____

(c) $y = g\left(\frac{1}{2}(x - 2)\right) + 2$

(c) _____

(d) $y = \frac{1}{3}g(x) - 2$

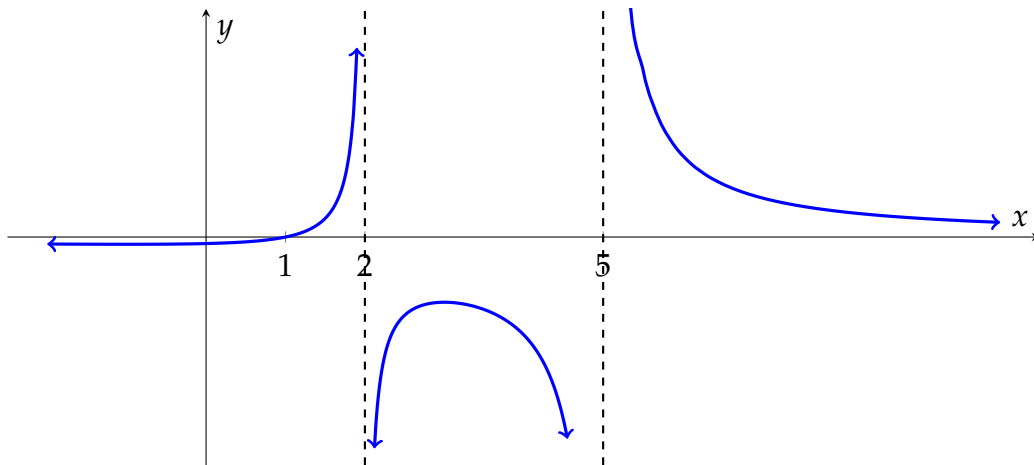
(d) _____

10. A quadratic function passes through $(4, 5)$ and has a vertex at $(6, 2)$.

(a) (5 points) Give a formula for the quadratic function. Write your formula giving y as a function of x .

(b) (3 points) Explain in a sentence what aspect of your formula tells you whether this is a concave up or concave down function.

11. (8 points) The function f is a rational function with a horizontal asymptote at $y = 0$. Its graph is shown below. Give a possible formula for $f(x)$.



12. The concentration of a particular mineral in the water in a lake is proportional to the square of the depth. Let $S(x)$ be the mineral concentration at a depth of x feet.

(a) (4 points) Write out the formula for $S(x)$ in terms of x and the constant of proportionality k .

(b) (4 points) At a depth of 10 feet, the mineral concentration is 20 grams per liter. Find k and rewrite the formula for S using it.

(c) (2 points) At what depth is the mineral concentration 180 grams per liter?