



Department of Mathematics and Statistics

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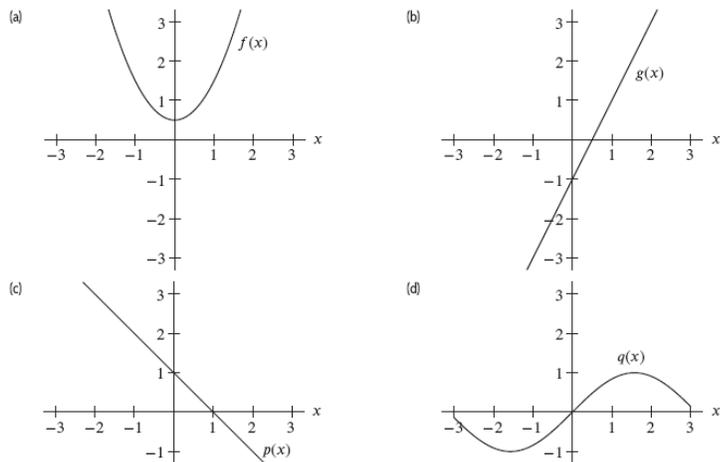
Common final exam for Math 117 Version 4

Directions:

- This exam has 16 questions. Please check that your exam is complete.
- You have two hours to complete this exam. It will be graded out of 100 points.
- You must be in the final exam [Zoom](#) room designated for [final](#) exams (communicated to you by your instructor) for proctoring. Exams from students not in the [Zoom](#) proctor room will not be graded.
- Show your work. Answers (even correct ones) without the corresponding work will receive no credit.
- You may use a calculator and your own notes from class. You may NOT use any internet resources, in particular you may NOT use Desmos, Mathematica, Google, WileyPlus, or Sakai Resources during the exam. The only computer use during the exam should be Zoom for proctoring and any writing tool you are using to transcribe your answers.
- You may not communicate with anyone besides the instructor during this exam.
- After you have finished your exam, convert it to a single pdf file and upload it to the test site in Sakai.

Good luck!

1. (Points: 6) Which of the functions in the figure below has rate of change 2 on the interval $0 \leq x \leq 1$?

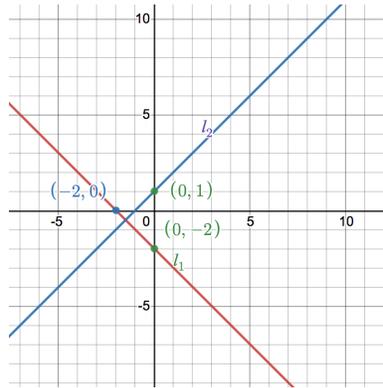


2. (Points: 6) Table below gives the cost, $C(n)$, of producing a certain good as a linear function of n , the number of units produced.

n (units)	80	115	130	135
$C(n)$ (dollars)	4920	7020	7920	8220

- (a) Estimate $C(0)$. What is the economic significance of this value?
- (b) The fixed cost of production is the cost incurred before any goods are produced. The unit cost is the cost of producing an additional unit. Find a formula for $C(n)$ in terms of n , given that Total cost = Fixed cost + Unit cost \cdot Number of units.

3. (Points: 6) Find the equation of the line l_2 in the Figure below.



4. (Points: 6) The volume of water in a reservoir $V(t)$ is changing with time: $V(t) = 650 - 5t$, where V is in gallons and time t is in minutes.
- (a) For $0 \leq t \leq 35$, when does the reservoir have the most water? When does it have the least water?
- (b) What are the domain and range of $V(t)$?

5. (Points: 6) Use $f(x) = 1 - 3x$ and $g(x) = 2x^2 - 1$ to simplify the following expressions.

(a) $g(f(2))$

(b) $g(g(x))$

6. (Points: 6) The cost, C , in thousands of dollars, of producing q kg of a chemical is given by $C = f(q) = 2q^3 + 3$. Find and interpret the following values.

(a) $f(5)$

(b) $f^{-1}(131)$

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

7. (Points: 6) Graph $f(x)$ with all of these properties:

(a) $f(0) = 1$

(b) f is increasing and concave up for $x < -1$

(c) f is increasing and concave down for $-1 < x < 0$

(d) f is decreasing and concave down for $0 < x < 1$

(e) f is decreasing and concave up for $x > 1$

8. (Points: 7) Find a formula for the quadratic function whose graph has a y -intercept of $y = -4$ and x -intercepts at $x = 2$, $x = 5$.

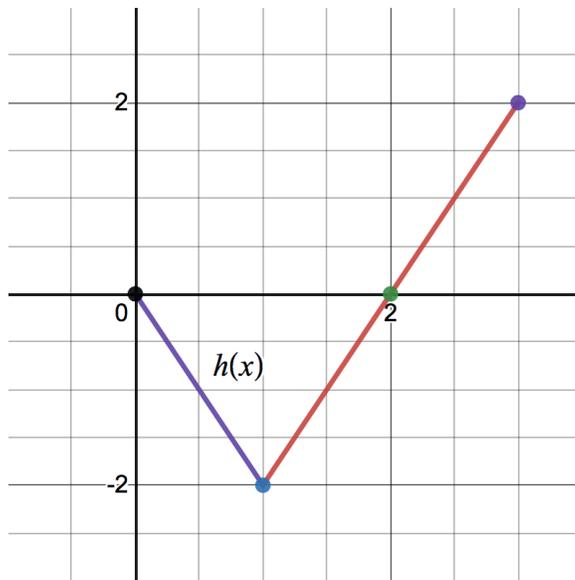
9. (Points: 6) The function $Q(t)$ has domain $t \geq 0$ and a range of $-6 < Q(t) < 2$. Give the domain and range for the following transformations of $Q(t)$.

(a) $y = Q(-t)$

(b) $y = -Q(t) + 2$

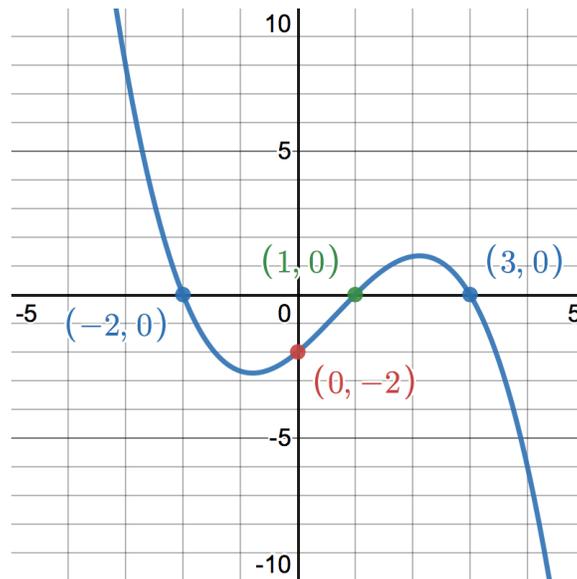
(c) $y = -Q(-t)$

10. (Points: 6) Given the graph of $y = h(x)$ below, sketch the graph of $y = -\frac{1}{4}h(x+2)$ on the same set of axes.



11. (Points: 6) Suppose c is inversely proportional to the square of t , $t \geq 0$.
- (a) If $c = 5$ when $t = 3$, find the constant of proportionality.
 - (b) Write a formula for c as a function of t .
 - (c) Use your formula from part (b) to find c when $t = 5$.
12. (Points: 6) Use the function formula $y = -x(2 + x^2)(2 - 4x)$ to answer the following questions.
- (a) What is the polynomial's lead term?
 - (b) What is its degree?
 - (c) Describe the long-run behavior of the polynomial as $x \rightarrow \infty$.
 - (d) Describe the long-run behavior of the polynomial as $x \rightarrow -\infty$.

13. (Points: 7) Find a possible formula for the following polynomial.



14. (Points: 6) Find the following limits.

(a) $\lim_{n \rightarrow \infty} \frac{2n^2}{1 - 5n^2}$

(b) $\lim_{x \rightarrow -\infty} \frac{1}{(2x - 6)(x + 1)}$

(c) $\lim_{t \rightarrow \infty} \frac{2t^5 - 2}{4t^3 - t}$

15. (Points: 8) Let t be the time in weeks. At time $t = 0$, organic waste is dumped into a pond. The oxygen level in the pond at time t is given by

$$f(t) = 2 \frac{t^2 - t + 1}{t^2 + 1}.$$

Assume $f(0) = 2$ is the normal level of oxygen.

- (a) What eventually happens to the oxygen level over large amounts of time?
- (b) Approximately how many weeks must pass before the oxygen returns to 80% of its normal level?

16. (Points: 6) Consider the rational function

$$y = \frac{x + 6}{x^2 + 6x - 7}.$$

- (a) What is the y -intercept?
- (b) Find any zeros of the function.
- (c) State the equations of any vertical asymptote.