



Department of Mathematics and Statistics

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Common final exam for Math 118 Version 1

Directions:

- This exam has 14 questions. Please check that your exam is complete.
- You have two hours to complete this exam. It will be graded out of 100 points.
- Show your work. Answers (even correct ones) without the corresponding work will receive no credit.
- You may not communicate with anyone besides the instructor during this exam.

Good luck!

- (Points: 6) The number of asthma sufferers in the world was about 84 million in 1990 and 334 million in 2012. Let N represent the number of asthma sufferers (in millions) worldwide t years after 1990.
 - Write a formula for $N = f(t)$ as a linear function of year t after 1990. What is the slope? What does it tell you about asthma sufferers?
 - Write a formula for $N = g(t)$ as an exponential function of year t after 1990. What is the growth factor? What does it tell you about asthma sufferers?
 - How many asthma sufferers are predicted worldwide in 2020 with the linear model? With the exponential model?

- (Points: 6) Rank the following three bank-deposit options from best to worst.
 - Bank A: 2% compounded daily
 - Bank B: 2.1% compounded monthly
 - Bank C: 2.05% compounded continuously

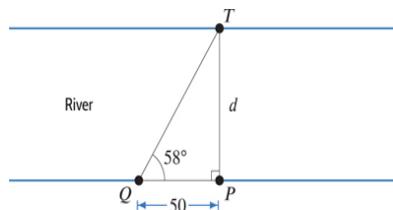
- (Points: 6) Technetium-99m is a radioactive substance used to diagnose brain diseases. Its half-life is approximately 6 hours. Initially you have 200 mg of technetium-99m.
 - Write an equation that gives the amount of technetium-99m remaining after t hours.
 - Determine the number of hours needed for your sample to decay to 120 mg.
 - Determine the concavity of the graph that models the quantity of technetium-99m using average rates of change over intervals of length 2 between $t = 0$ and $t = 6$.

- (Points: 6) A \$5000 investment earns 7.2% annual interest, and an \$8000 investment earns 5.4%, both compounded annually. How long will it take for the smaller investment to catch up to the larger one?

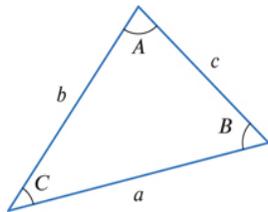
- (Points: 6) Let $f(x) = 3^x$ and $g(x) = x^3$.
 - Complete the following table of values:

x	-3	-2	-1	0	1	2	3
$f(x)$							
$g(x)$							
 - Describe the long-run behaviors of f and g as $x \rightarrow -\infty$ and as $x \rightarrow \infty$.

6. (Points: 6) Find angles between 0° and 360° (but not 240°) that have the same
- Cosine as 240° .
 - Sine as 240° .
7. (Points: 6) The pressure, P (in lbs/ft^2), in a pipe varies over time. Five times an hour, the pressure oscillates from a low of 90 to a high of 230 and then back to a low of 90. The pressure at $t = 0$ is 90.
- Graph $P = f(t)$, where t is time in minutes. Label your axes.
 - Find a possible formula for $P = f(t)$.
 - By graphing $P = f(t)$ for $0 \leq t \leq 2$, estimate when the pressure first equals $115 lbs/ft^2$.
8. (Points: 6) If $\cos(\alpha) = -\sqrt{3}/5$ and α is in the third quadrant, find the exact values for $\sin(\alpha)$ and $\tan(\alpha)$.
9. (Points: 7) Without a calculator, evaluate the following exactly.
- $\cos(\cos^{-1}(1/2))$
 - $\cos^{-1}(\cos(7\pi/6))$
10. (Points: 6) A surveyor must measure the distance between the two banks of a straight river. She sights a tree at point T on the opposite bank of the river and drives a stake into the ground (at point P) directly across from the tree. Then she walks 50 meters upstream and places a stake at point Q . She measures angle PQT and finds that it is 58° . Find the width of the river.



11. (Points: 6) Find the missing sides, a , b , and angle B , (if possible).
 $A = 12^\circ$, $C = 150^\circ$, $c = 5$.



12. (Points: 6) Use a graph to approximate solutions to the equation $\cos(t) = 0.6$ on $0 \leq t \leq 4\pi$.
13. (Points: 6) Decompose the function

$$f(x) = 5\sqrt{x+3}$$

into two new functions u and v , where v is the inside function, that is $f(x) = u(v(x))$, $u(x) \neq x$, and $v(x) \neq x$.

14. (Points: 7) Let $P = f(t) = 37.8(1.044)^t$ be the population of a town (in thousands) in year t .
- Describe the town's population in words.
 - Evaluate $f(50)$. What does this quantity tell you about the population?
 - Find a formula for $f^{-1}(P)$ in terms of P .
 - Evaluate $f^{-1}(50)$. What does this quantity tell you about the population?