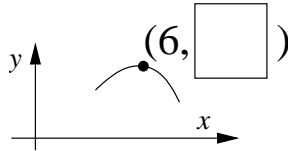


Sample Final Exam
Math 19, Fall 2009

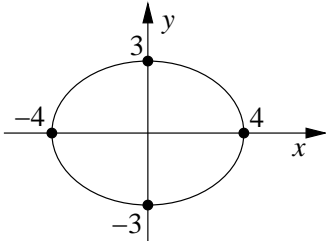
1. (6 points) Let f be a function described by the following table.

x	3	4	5	6	7	8	9
$f(x)$	8	5	3	7	4	6	2

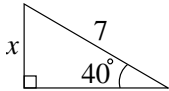
Part of the graph of $y = f(x)$ is shown below (not to scale). Find the other coordinate of the indicated point, and circle or otherwise indicate the part of the table that justifies your answer.



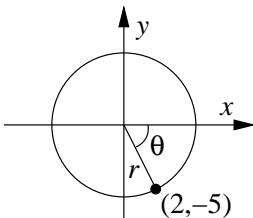
2. (6 points) Find the equation of the line with slope 17 that passes through the point $(2, -37)$. No explanation necessary; please do not simplify your answer.
3. (8 points) Find the equation of the ellipse shown below. No explanation necessary.



4. (8 points) Write $\ln \left[\frac{x^3 \sqrt{x^2 + 1}}{(x - 1)(x + 2)} \right]$ as a sum and/or difference of logarithms, expressing powers as factors. Show all your work.
5. (8 points) Find the value of x for the triangle below. Show all your work. Round off your answer to two decimal places.



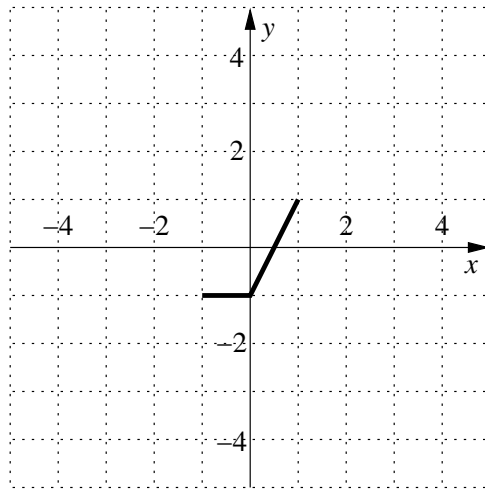
6. (8 points) Consider the angle θ that crosses the circle of radius r centered at the origin at $(-2, 5)$, as shown below (not to scale). Find r , and find the exact values of the six trig functions of θ . Show all your work. Please do not simplify your final answers.



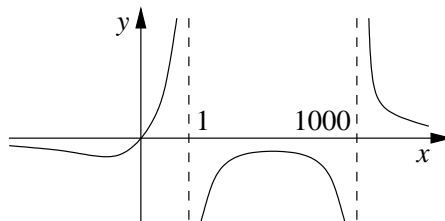
7. (8 points) Solve the inequality

$$\frac{(x+2)^2(x+3)}{(x-500)} > 0.$$

8. (8 points) Let $y = f(x)$ be the function whose graph is shown on the axes below. On the same set of axes, draw the graph of $y = 3f(x-2)$.



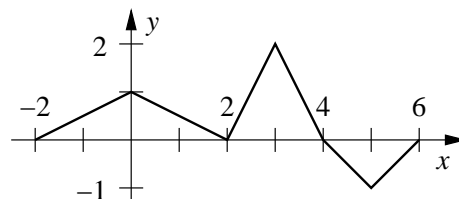
9. (8 points) Suppose we have a rational function with the following graph:



CIRCLE the equation below that best matches the above graph and **JUSTIFY** your answer.

$$R_1(x) = \frac{(x-1)(x-1000)}{x} \quad R_2(x) = \frac{x}{(x-1)(x-1000)} \quad R_3(x) = \frac{1}{x(x-1)(x-1000)}$$

10. (12 points) Consider the function $y = f(x)$ whose graph is shown below.



- (a) List the intervals on which f is **decreasing**. No explanation necessary.
 (b) List the x -intercepts of the graph. No explanation necessary.

11. (12 points) Suppose $\sin \theta = \frac{1}{3}$ and $\frac{\pi}{2} \leq \theta \leq \pi$.

- (a) Find the exact value of $\cos \theta$. Justify any sign choices you make.
 (b) Find the exact value of $\cos(2\theta)$.
 (c) Find the exact value of $\sin\left(\frac{\theta}{2}\right)$. Justify any sign choices you make.

12. (12 points) Joey owes \$1,275 to Louie the Loan Shark, who charges 1.5% interest per day. At that rate, t days from now, Joey will owe Louie

$$P(t) = 1275(1.015)^t$$

dollars. How many days from now will Joey owe Louie \$2,000?

13. (12 points) Solve the triangle: $b = 4$, $A = 30^\circ$, $c = 3$.

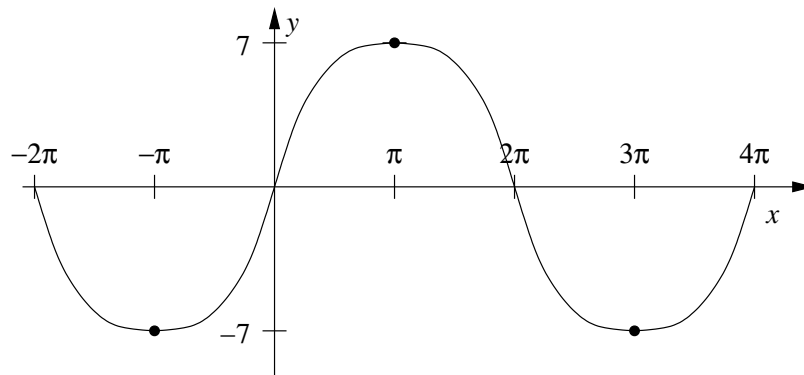
14. (12 points) For the function $y = 71 \cos(5\pi x)$:

- (a) Find the amplitude.
 (b) Find the period.
 (c) Graph the function.

15. (12 points) Find the exact value of $\tan\left(\sin^{-1}\left(-\frac{3}{11}\right)\right)$. Show all your work, and briefly **justify** any choices of signs (\pm) that you make.

16. (12 points) For the sinusoidal graph shown below:

- (a) Find the amplitude and period.
 (b) Find an equation for the graph.



17. (12 points) Billie runs a skateboard company and is trying to decide what price to charge for her skateboards. She determines that if she charges x dollars per skateboard, her profit will be

$$P(x) = -2x^2 + 240x - 200.$$

If she wants to maximize her profit, what price should she charge for each skateboard? What will her maximum profit be?

18. (12 points) Let $f(x) = (x + 3)(x - 2000)^2(x - 2001)^3$. Show all your work.

- Is the y -intercept of $f(x)$ positive or negative?
- List each real zero of $f(x)$ and its multiplicity.
- For each x -intercept of $y = f(x)$, determine the behavior of the graph $y = f(x)$ near that x -intercept; in particular, determine if the graph cuts the x -axis, bumps the x -axis, or slides through the x -axis.
- Sketch the graph of $y = f(x)$, making sure that all of the above information is indicated clearly.

19. (12 points) Throughout this problem, we consider the hyperbola

$$-\frac{(x - 1)^2}{4} + \frac{(y + 3)^2}{49} = 1.$$

- Graph the hyperbola.
- Label the vertices of the hyperbola.
- Draw the asymptotes of the hyperbola.
- Find the equation of each asymptote, and label each asymptote with its equation.

20. (12 points) Given:

$$f(x) = \left(\frac{1}{2}\right) \ln(x - 7)$$

- Find a formula for $f^{-1}(x)$.
- Graph both $f(x)$ and $f^{-1}(x)$. Make sure you clearly indicate which graph is which, make sure that you label all intercepts and asymptotes of each function, and make sure you make it clear which asymptotes go with which function.