

**1 Do five of the following six problems: 1–6**

1. Prove the trigonometric identity  $\frac{\sin 2x}{1+\cos 2x} = \tan x$ .
2. Simplify  $\frac{x+3}{4x^2-9} \div \frac{x^2+7x+12}{2x^2+7x-15}$ .
3. Rewrite without parentheses or a radical sign  $y^{\frac{3}{5}}(\sqrt{y} - \frac{1}{\sqrt{y}})$ .
4. Solve  $\frac{5}{x+2} - \frac{6}{x} + 1 = 0$  for  $x$ .
5. Find all  $x$  that solve  $x^3 > x^2$ .
6. Given  $f(x) = 2x - 4x^2$ . Find and simplify
  - (a)  $f(3 - a)$
  - (b)  $f(\frac{a}{2})$

**2 Do five of the following six problems: 7–12**

7. Show that the equation  $x^2 + y^2 + \frac{1}{2}x - 2y + \frac{1}{16} = 0$  represents a circle, and find its center and radius.
8. Given  $f(t) = t - 2t^2$ . Find and simplify the average rate of change of  $f$  from  $t = 2$  to  $t = 2 + h$ .
9. Sketch the graph of the function  $y = 2 - \sqrt{x+1}$ . Label at least three points on your graph including any intercepts. Begin with  $y = \sqrt{x}$  and indicate the steps needed to transform its graph to the graph of  $y = 2 - \sqrt{x+1}$ .
10. Given  $f(x) = \frac{x}{x+1}$  and  $g(x) = \frac{2}{x}$ . Evaluate and simplify  $f(g(7)) - g(f(7))$ .
11. Let
$$f(x) = \begin{cases} 1 - 2x & \text{if } x \leq 1, \\ 2x & \text{if } x > 1 \end{cases}$$
  - (a) Evaluate  $f(-2)$  and  $f(1)$ .
  - (b) Sketch the graph of  $f(x)$  from  $x = -3$  to  $x = 3$ .
12. Sketch the graph of  $p(x) = -x(x+2)^2(x-2)^3$ . Label all intercepts and indicate the end behavior.

**3 Do five of the following six problems: 13–18**

13. A bacteria culture starts with 900 bacteria. After one hour the count is 1000.
  - (a) Assuming that bacteria population grows exponentially, find a function that models the number of bacteria  $n(t)$  after  $t$  hours. (You may leave  $e$ ,  $\log$ , or  $\ln$  in your answer).
  - (b) After how many hours will the number of bacteria double? (You may leave  $e$ ,  $\log$ , or  $\ln$  in your answer).
14. Given the function  $f(x) = 2 - x^3$ .
  - (a) Sketch the graph of  $f$ .
  - (b) Find the formula for the inverse function  $f^{-1}(x)$ .
15. For the graph of the function in Figure 1, determine the interval(s) on which the function is increasing.
16. Solve for  $t$  in each of the following parts. You may leave  $e$ ,  $\log$ , or  $\ln$  in your answer.

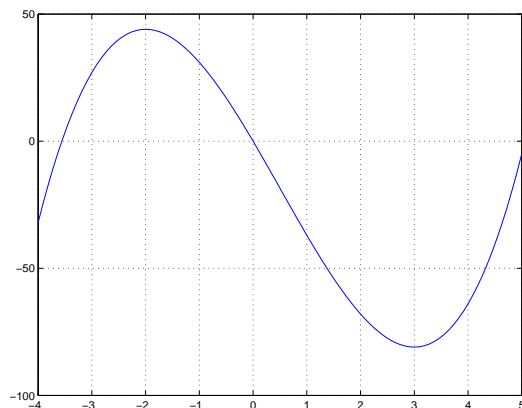


Figure 1:

(a)  $5e^{2t} - 20 = 0$

(b)  $3 - \log(3 - x) = 1.$

17. Evaluate  $\log_3\left(\frac{1}{\sqrt{27}}\right).$

18. Perform the subtraction  $\frac{7}{x+6} - \frac{1}{x^2+8x+12}$  and simplify.

#### 4 Do five of the following six problems: 19–24

19. Find the exact value of  $\tan\left(-\frac{20\pi}{3}\right).$

20. For  $y = -3\sin\left(x + \frac{\pi}{6}\right)$  find the amplitude, period, phase shift and then graph. Label the coordinates of three points on your graph: one maximum point, one minimum point and one intercept.

21. Find  $\cos 105^\circ.$

22. Find all solutions  $\theta$  to  $6\cos^2\theta - 3 = 0$  for  $\theta$  in the interval  $-\pi \leq \theta \leq \pi.$

23. Evaluate each of the following

(a)  $\sin^{-1}\left(\frac{\sqrt{2}}{2}\right)$

(b)  $\arcsin\left(\sin\left(\frac{11\pi}{6}\right)\right)$

24. Find the radius  $r$  of the circle in Figure 2 with shaded angle of measure  $\frac{1}{2}$  radians that is subtended by the arc  $s$  of length 6.

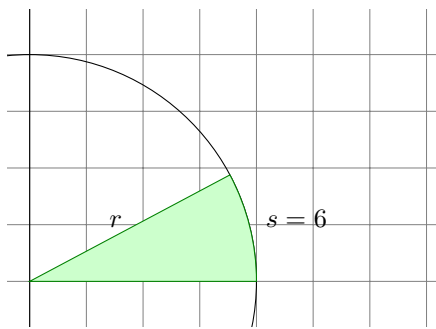


Figure 2: