

1. (5 points) Given  $\tan \theta = 2$  and  $\sin \theta < 0$ . Find  $\cos(\theta + \frac{\pi}{4})$ .
2. (5 points) Solve  $\frac{x+5}{x-2} = \frac{5}{x+2} + \frac{28}{x^2-4}$  for  $x$ .
3. (5 points) Simplify  $\log_2\left(\frac{8}{\sqrt{32}}\right)$ .
4. (5 points) A bacteria culture grows exponentially and starts with 800 bacteria. After one hour the count is 1000 bacteria.
  - (a) Find the number of bacteria after 2 hours. (You may use  $e$ ,  $\ln$ , or  $\log$  to express your answer.)
  - (b) After how many hours will the number of bacteria double? (You may use  $e$ ,  $\ln$ , or  $\log$  to express your answer.)
5. (5 points) Let  $f(x) = \sqrt{1-x^2}$ .
  - (a) Find the domain of  $f$ .
  - (b) Evaluate  $f(f(\frac{1}{2}))$ .
  - (c) Evaluate and simplify  $f(f(2x))$ .
6. (5 points) Given  $f(x) = x - x^2$ . Find and simplify the difference quotient  $\frac{f(a+h)-f(a)}{h}$  when  $h \neq 0$ .
7. (5 points) Solve the inequality  $x^3 + 18x \leq 11x^2$ . Express the solution using interval notation and graph the solution set on the real number line.
8. (5 points)
  - (a) Find the quotient and remainder of the rational expression  $\frac{4x-5}{x+1}$ .
  - (b) Use transformations and part (a) to graph of  $y = \frac{4x-5}{x+1}$ . Label intercepts and asymptotes on your graph.
9. (5 points) Sketch the graph of  $f = 2 - x - x^2$ . Label all local maximums and minimums and intercepts on your graph. State the intervals on which  $f$  is increasing and on which  $f$  is decreasing.
10. (5 points) Verify the identity  $\frac{1+\tan^2 x}{1-\tan^2 x} = \frac{1}{\cos^2 x - \sin^2 x}$ .
11. (5 points) Let  $f(x) = \frac{x}{x+4}$ . Find  $f^{-1}(x)$ .
12. (5 points) Sketch the graph of the polynomial  $y = -x^3 + 10x^2$ . Make sure that your graph shows all intercepts and exhibits the proper end behavior.
13. (5 points) Use transformations to graph the function  $f(x) = -e^{x+2} - 1$ . State the domain, range, and asymptote(s).
14. (5 points) Solve  $2 - \log_2(x+1) = \log_2(x+4)$  for  $x$ .
15. (5 points) Sketch the graph of one complete period of the function  $y = -2 \cos(2x + \frac{\pi}{2})$ .
16. (5 points) Find an equation of the circle with center  $(-1, 5)$  that passes through the point  $(4, 6)$ .
17. (4 points) Find  $\cos \frac{\pi}{8}$ .
18. (4 points) Solve  $4 \cos^2(\theta) - 3 = 0$  for  $\theta$  for  $0 \leq \theta \leq 2\pi$ .
19. (4 points) If  $\sin \theta = \frac{5}{13}$  and  $\tan \theta = -\frac{5}{12}$ . Find  $\sec \theta$ .
20. (4 points) Evaluate  $\cot\left(\sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)\right)$ .
21. (4 points) In 2.5 hours an airplane travels 600 km against the wind. It takes 50 min to travel 300 km with the wind. Find the speed of the wind and the speed of the airplane in still air.