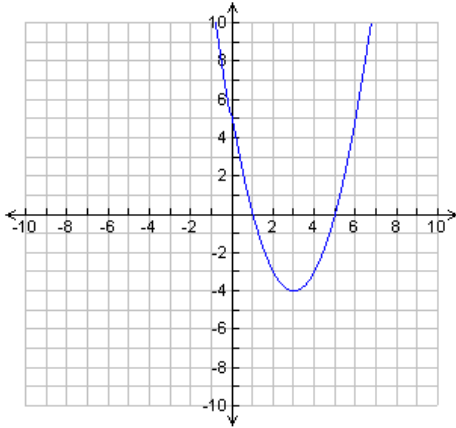


1. Given the following graph of a function  $f$ ,



(4 pt.) a. Find the domain of  $f$ .

(4pt.) b. Find the range of  $f$ .

(2 pt.) c. Find  $f(6)$ .

2. Given  $f(x) = x^2$ , let  $g(x) = f(x-3) - 4$ .

Sketch the graph of  $g(x)$  below, labeling the vertex and x-intercepts of the graph.

(Graph 8 pt., vertex 2 pt.)

(10 pt.) 3. Given  $f(x) = x^2 + x$ , find the average rate of change of  $f$  from  $x = 2$  to  $x = 3$ .

(10 pt.) 4. Given the polynomial function  $P(x) = x^3 - 2x^2 - 5x + 6$ , use the factor theorem to determine whether  $x - 1$  is a factor of  $P(x)$ . If so, express  $P(x)$  as a product of linear factors.

**5. The Intermediate Value Theorem for Polynomial Functions:** If  $f$  is a polynomial function and  $[a, b]$  is a closed interval from the domain of  $f$ , then  $f$  takes on every value between  $f(a)$  and  $f(b)$  in the interval  $[a, b]$ .

(6 pt.) **a.** Use the intermediate value theorem to show that  $f(x) = x^5 - 2$  has a zero between  $x=1$  and  $x=2$ .

(4 pt.) **b.** Use your calculator to estimate the zero to at least two decimal places of accuracy.

**6.** Given the rational function  $r(x) = \frac{x+1}{x-2}$

(2 pt.) **a.** Find the equation of the vertical asymptote of the graph of  $r(x)$ .

(2 pt.) **b.** Find the  $x$  and  $y$  intercept(s) of the graph of  $r(x)$ .

(2 pt.) **c.** Find the equation of the horizontal asymptote of the graph of  $r(x)$ .

(4 pt.) **d.** Sketch the graph of  $r(x)$ .

**7.** Given  $f(x) = \cos(x)$  and  $g(x) = x^2$ , find the following.

(6 pt.) **a.**  $(f \circ g)(x)$

(4 pt.) **b.**  $(g \circ f)(x)$

(10 pt.) **8.** Solve the equation. Leave your answer in exact form.

$$\log(x) - \log(x - 48) = 1$$

**9.** The number of bacteria on a certain culture increases exponentially over time. The number  $f(t)$  of bacteria after  $t$  hours is given by

$$f(t) = 200e^{0.75t}$$

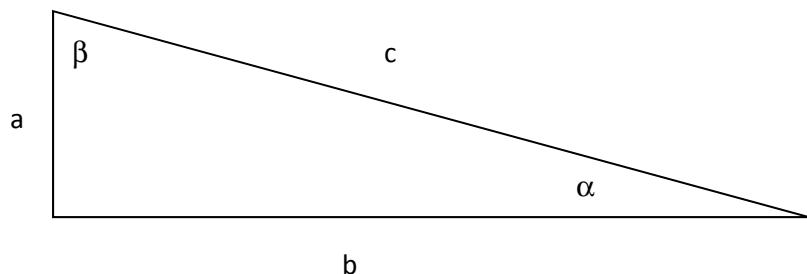
(2 pt.) **a.** What is the initial number of bacteria? ( $t=0$ )

(4 pt.) **b.** Estimate the number of bacteria in the culture after two hours. Round your answer to the nearest whole number.

(4 pt.) **c.** How long will it take for the number of bacteria to become 4000? Round your answer to the nearest whole number of hours.

(10 pt.) **10.** Find the inverse function of  $f(x) = \frac{x-2}{x+3}$ .

11. Solve the right triangle for angle  $\beta$  and sides b and c, given that  $\alpha = 32^\circ$  and side a = 10.2. Round sides to one decimal place. (angle 2 pt., sides 4 pt. ea.)



12. Find the exact values of the following.

(4 pt.) a.  $\sec\left(\frac{5\pi}{3}\right)$

(4 pt.) b.  $\cos\left(\frac{7\pi}{6}\right)$

(2 pt.) c.  $\tan(3\pi)$

13. Given the trigonometric function

$$f(x) = 2 \sin 2\left(x - \frac{\pi}{2}\right)$$

(2 pt.) a. Determine the amplitude of  $f(x)$ .

(2 pt.) b. Determine the period of  $f(x)$ .

(2 pt.) c. Determine the phase shift of  $f(x)$ .

(4 pt.) d. Sketch two periods of the graph of  $f(x)$ .

(10 pt.) 14. A ramp is to be built to access a porch that is 2 feet high. How long must the sloped part of the ramp be if it makes an  $8^\circ$  angle with the ground?

(10 pt.) 15. Verify the following trigonometric identity.

$$\frac{\cos(t)}{1 - \sin(t)} - \frac{\sin(t)}{\cos(t)} = \sec(t)$$

(10pt.) **16.** Solve the following equation in the interval  $[0, 2\pi)$ . State your answers correct to three decimal places.

$$7\cos(x) - 1 = 0$$

(10 pt.) **17.** Find all solutions to the following equation. Give your answers in exact form.

$$\cot(\theta) = 1$$

**18.** Find the exact value of the following expressions.

(6 pt.) **a.**  $\cos\left(\tan^{-1}\left(\frac{9}{40}\right)\right)$

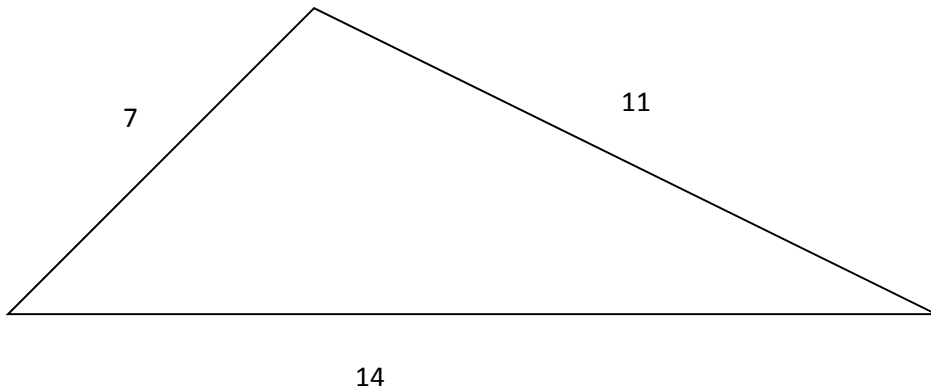
(4 pt.) **b.**  $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

**19.** If  $\sin(\theta) = -\frac{4}{5}$ , and  $\theta$  is an angle in quadrant III, find the exact value of the following.

(6 pt.) **a.**  $\sin\left(\frac{\theta}{2}\right)$

(4 pt.) **b.**  $\cos(2\theta)$

**20.** Refer to the figure below, depicting a triangle with sides shown.



(6 pt.) **a.** Find the angle (in degrees) opposite the longest side. State your answer to the nearest tenth.

(4 pt.) **b.** Find the area of the triangle. State your answer to the nearest tenth.