

1 Simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$, if $h \neq 0$, for $f(x) = \frac{1}{5-x}$.

a. $\frac{1}{(5-x+h)(5-x)}$

b. $\frac{1}{h(5-x)^2}$

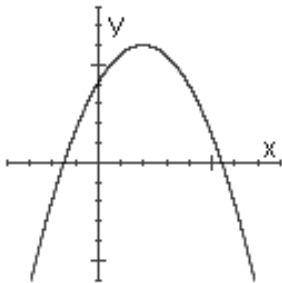
c. $\frac{-1}{(5-x+h)(5-x)}$

d. $\frac{-1}{(5-x-h)(5-x)}$

e. $\frac{-1}{h(5-x)^2}$

f. $\frac{1}{(5-x-h)(5-x)}$

2 Write an equation for the given graph if the point $(2, 2)$ is on the curve.



a. $(x+1)^2 = y+3$

b. $(x-1)^2 = y-3$

c. $(x+1)^2 = -(y+3)$

d. $(y+3)^2 = -(x+1)$

e. $(y-3)^2 = -(x-1)$

f. $(x-1)^2 = -(y-3)$

3 Find equations of two successive vertical asymptotes of the graph of f .

$$f(x) = \tan\left(\frac{1}{2}x - \frac{\pi}{3}\right)$$

a. $x = -\frac{5\pi}{6}, x = \frac{\pi}{6}$

b. $x = -\frac{5\pi}{3}, x = \frac{\pi}{3}$

c. $x = -\frac{\pi}{6}, x = \frac{5\pi}{6}$

d. $x = -\pi, x = 5\pi$

e. $x = -\frac{\pi}{3}, x = \frac{5\pi}{3}$

f. $x = -5\pi, x = \pi$

4 A ship is 11 miles east and 4 miles south of a harbor. What bearing should be taken to sail directly to the harbor?

a. $S \left[\arctan\left(\frac{11}{4}\right) \right]^\circ W$

b. $S \left[\arctan\left(\frac{4}{11}\right) \right]^\circ E$

c. $N \left[\arctan\left(\frac{11}{4}\right) \right]^\circ W$

d. $N \left[\arctan\left(\frac{4}{11}\right) \right]^\circ W$

e. $S \left[\arctan\left(\frac{11}{4}\right) \right]^\circ E$

f. $N \left[\arctan\left(\frac{11}{4}\right) \right]^\circ E$

- 5 A roof truss is made in the shape of an inverted asymmetrical V. The lengths of the two edges are 5 meters and 11 meters respectively. The edges meet at the peak making a 60° angle.

a) Find the width of the truss.

a. $\sqrt{110 - 55\sqrt{3}}$ meters

b. $\sqrt{146 - 55\sqrt{3}}$ meters

c. $\sqrt{146}$ meters

d. $\sqrt{91}$ meters

e. $\sqrt{96 - 55\sqrt{3}}$ meters

f. $\sqrt{96}$ meters

b) Find the height of the peak.

a. $\frac{55}{2\sqrt{146}}$ meters

b. $\frac{55}{2} \sqrt{\frac{3}{146}}$ meters

c. $\frac{55}{2} \sqrt{\frac{3}{91}}$ meters

d. $\frac{55}{2} \sqrt{\frac{3}{96}}$ meters

e. $\frac{55}{2\sqrt{91}}$ meters

f. $\frac{55}{2\sqrt{96}}$ meters

6 Find the EXACT value of $\tan^{-1}\left(\tan \frac{9\pi}{7}\right)$.

a. $\frac{9\pi}{7}$

b. $-\frac{2\pi}{7}$

c. $\frac{5\pi}{7}$

d. $-\frac{9\pi}{7}$

e. $\frac{2\pi}{7}$

f. $-\frac{5\pi}{7}$

7 Find all solutions to the given equation in the interval $[0, 2\pi)$.

$$\cos(2x) + \sin^2 x = 0$$

8 Find an equation in x and y that has the same graph as the polar equation.

$$r^2 \sin(2\theta) = 6$$

a. $x = 3y$

b. $x + y = 6$

c. $y = 6x$

d. $x \cdot y = 6$

e. $x \cdot y = 3$

f. $x + y = 3$

9 Find the solutions of the equation that are in the interval $[0, 2\pi)$.

$$2 \cos^2 x + 3 \sin x = 0$$

10 Find the foci and asymptotes for the given conic.

$$x^2 - y^2 - 2x - 4y - 4 = 0$$

- a. Foci: $(0, -2), (2, -2)$ Asymptotes: $y + 2 = \pm(x - 1)$
b. Foci: $(1 \pm \sqrt{2}, -2)$ Asymptotes: $y + 2 = \pm(x + 1)$
c. Foci: $(-2, 2), (4, 2)$ Asymptotes: $y - 2 = \pm(x - 1)$
d. Foci: $(-1 \pm \sqrt{2}, 2)$ Asymptotes: $y - 2 = \pm(x + 1)$
e. Foci: $(1 \pm \sqrt{2}, -2)$ Asymptotes: $y + 2 = \pm(x - 1)$
f. Foci: $(1 \pm 3\sqrt{2}, 2)$ Asymptotes: $y - 2 = \pm(x - 1)$

11 $\tan\left[2 \arccos\left(-\frac{3}{5}\right)\right] =$

- a. $-\frac{8}{3}$
b. $\frac{24}{7}$
c. $\frac{4}{3}$
d. $-\frac{4}{3}$
e. $\frac{8}{3}$
f. $-\frac{24}{7}$

12 For the given parametric equations, find the x/y-equation.

$$x = t^2 - 14t + 49, \quad y = t - 7$$

a. $x = (y - 7)^2 - 14(y - 7) + 49$

b. $x = \left(\frac{y}{7}\right)^2 - 14\left(\frac{y}{7}\right) + 49$

c. $y = \sqrt{x}$

d. $y = x^2$

e. $x = y^2$

f. $x = y^2 - 14(y + 7)$

13 $\sin^{-1}\left(-\frac{1}{2}\right) =$

a. $\frac{5\pi}{3}$

b. $-\frac{5\pi}{6}$

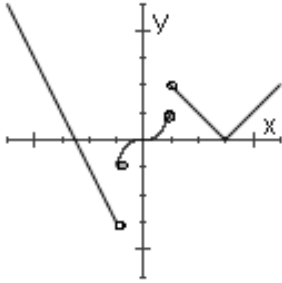
c. $-\frac{\pi}{6}$

d. $-\frac{\pi}{3}$

e. $\frac{11\pi}{6}$

f. $\frac{7\pi}{6}$

14 For the given graph of $f(x)$, as $x \rightarrow 1^+$, $f(x) \rightarrow$ ____ .

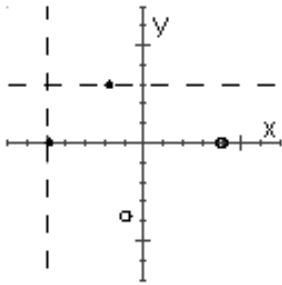


- a. 2
- b. 1
- c. ∞
- d. -3
- e. -1
- f. $f(x)$ does not approach any value as $x \rightarrow 1^+$.

15 $\frac{\sec^2 t}{\tan t}$ is equivalent to which of the following?

- a. $\csc t$
- b. $\sin t \cos t$
- c. $\sec t \csc t$
- d. $\cos t \sin^3 t$
- e. $\cot t$
- f. none of the above

16 All asymptotes, intercepts, and holes of a rational function f are shown in the figure. Select an equation for f .



a. $f(x) = \frac{(x-4)(x-3)}{(x+1)(x+5)}$

b. $f(x) = \frac{3(x+4)(x-1)}{(x-1)(x-5)}$

c. $f(x) = \frac{3(x-4)(x+1)}{(x+5)^2}$

d. $f(x) = \frac{3(x+5)(x+1)}{(x+1)(x-4)}$

e. $f(x) = \frac{3(x-4)(x+1)}{(x+1)(x+5)}$

f. $f(x) = \frac{(x+4)(x+3)}{(x-1)(x-5)}$

17 Suppose that a robotic arm can rotate between $\theta_1 = -20^\circ$ and $\theta_2 = 100^\circ$. If the length of the arm can vary between 4 inches to 20 inches, find the area of the work space.

a. 23040 in^2

b. $\frac{384\pi}{3} \text{ in}^2$

c. $\frac{256\pi}{3} \text{ in}^2$

d. $\frac{400\pi}{3} \text{ in}^2$

e. 15360 in^2

f. $\frac{16\pi}{3} \text{ in}^2$

18 Find all solutions to the given equation in the interval $[0, 2\pi)$.

$$\tan \gamma = -5$$

- a. $\gamma = \arctan(-5), \gamma = 2\pi - \arctan(-5)$
- b. $\gamma = \pi + \arctan(-5), \gamma = 2\pi - \arctan(-5)$
- c. $\gamma = \pi - \arctan(-5), \gamma = 2\pi - \arctan(-5)$
- d. $\gamma = \pi + \arctan(5), \gamma = 2\pi - \arctan(5)$
- e. $\gamma = \pi - \arctan(5), \gamma = 2\pi - \arctan(5)$
- f. $\gamma = \arctan(-5), \gamma = \pi - \arctan(-5)$

19 $\cos \left[\frac{7\pi}{6} - \sin^{-1} \left(-\frac{5}{13} \right) \right] =$

- a. $\frac{5 + 12\sqrt{3}}{26}$
- b. $\frac{5 - 12\sqrt{3}}{26}$
- c. $\frac{12 - 5\sqrt{3}}{26}$
- d. $\frac{12\sqrt{3} - 5}{26}$
- e. $\frac{5\sqrt{3} - 12}{26}$
- f. $\frac{-5 - 12\sqrt{3}}{26}$

20 The Ellipse is a park in Washington, D.C. It is bounded by an elliptical path with a major axis of length 460 m and a minor axis of length 400 m. Find the distance between the foci of this ellipse.

a. $2\sqrt{92900}$ m

b. $\sqrt{51600}$ m

c. $2\sqrt{371600}$ m

d. $\sqrt{12900}$ m

e. $2\sqrt{51600}$ m

f. $2\sqrt{12900}$ m

21 $\sin\left(-\frac{5\pi}{2}\right) =$

$\tan\left(-\frac{3\pi}{4}\right) =$

22 Find all solutions of the equation.

$$\sec \theta = -2$$

a. $\theta = \frac{5\pi}{6} + 2\pi n, \theta = \frac{7\pi}{6} + 2\pi n$

b. $\theta = \frac{7\pi}{6} + 2\pi n, \theta = \frac{11\pi}{6} + 2\pi n$

c. $\theta = \frac{4\pi}{3} + 2\pi n, \theta = \frac{5\pi}{3} + 2\pi n$

d. $\theta = \frac{2\pi}{3} + \pi n, \theta = \frac{4\pi}{3} + \pi n$

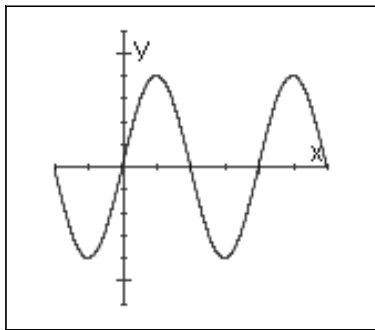
e. $\theta = \frac{2\pi}{3} + 2\pi n, \theta = \frac{4\pi}{3} + 2\pi n$

f. $\theta = \frac{7\pi}{6} + \pi n, \theta = \frac{11\pi}{6} + \pi n$

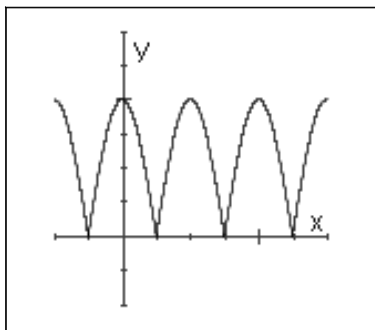
23 Insulation must be put into the space between 2 concentric cylinders. Write a function for the volume V between the inner and outer cylinders if the inner cylinder has a radius 5 feet, the outer cylinder has radius x feet, and both cylinders are 9 feet high.

- a. $V(x) = 9\pi x(x + 10)$
- b. $V(x) = 9\pi(x - 5)^2$
- c. $V(x) = (x + 5)(x - 5)$
- d. $V(x) = 9\pi x^2$
- e. $V(x) = 9\pi(x - 5)(x + 5)$
- f. $V(x) = 18\pi(x - 5)$

24 Match each graph in the left-hand column with its equation on the right.



$$y = |2 \cos(\pi x)|$$



$$y = 2 \sin(\pi x)$$

$$y = 2 \cos(2x)$$

$$y = |2 \sin(\pi x)|$$

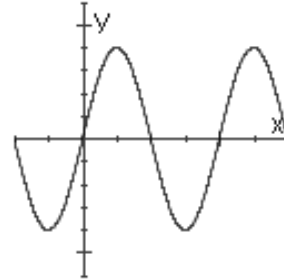
$$y = 2 \cos(\pi x)$$

$$y = 2 \sin(2x)$$

ANSWER KEY

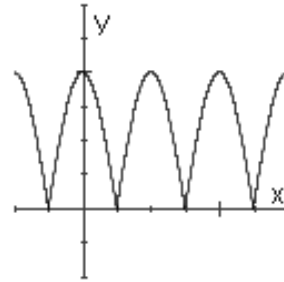
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|------------------------------------|-------|--------------------------------------|-------|---|-------|
| 1. f | 2. f | 3. e | 4. c | 5. $\begin{matrix} d \\ c \end{matrix}$ | 6. e |
| 7. $\frac{\pi}{2}, \frac{3\pi}{2}$ | 8. e | 9. $\frac{7\pi}{6}, \frac{11\pi}{6}$ | 10. e | 11. b | 12. e |
| 13. c | 14. a | 15. c | 16. e | 17. b | 18. e |



→ $y = 2 \sin(\pi x)$,

- | | | | | | |
|-------|-------|------------|-------|-------|-----|
| 19. b | 20. f | 21. - 1; 1 | 22. e | 23. e | 24. |
|-------|-------|------------|-------|-------|-----|



$y = |2 \cos(\pi x)|$

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