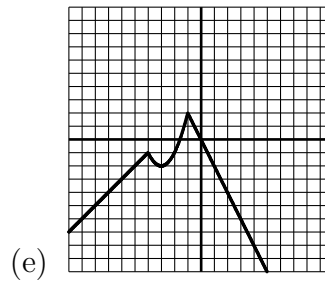
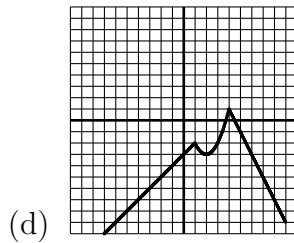
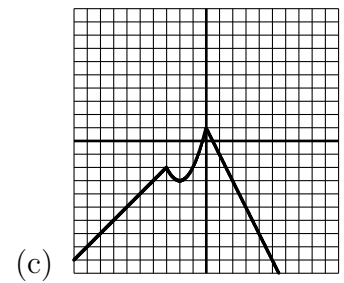
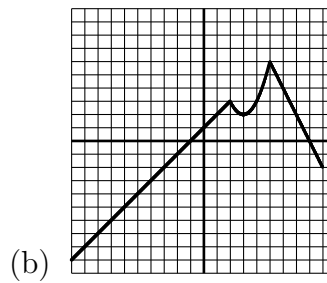
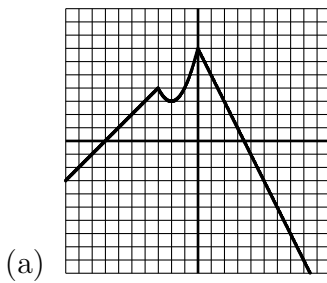
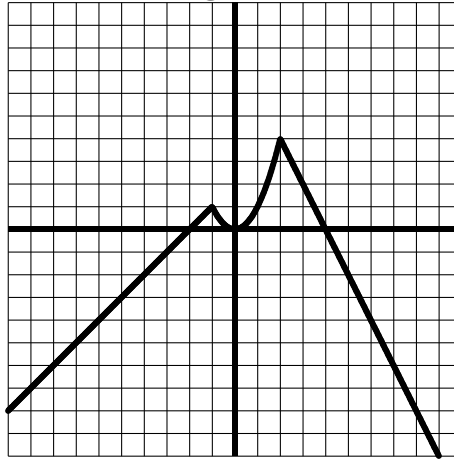


1. If Figure 1 is the graph of the function $y = f(x)$, which of the five graphs following is the graph of the function $y = f(x + 2) - 3$?

Figure 1



2. The population of Jefferson City is projected to grow at a rate of 4% annually. If the current population is 6500, and the model holds true, then the population at the end of 4 years would be about

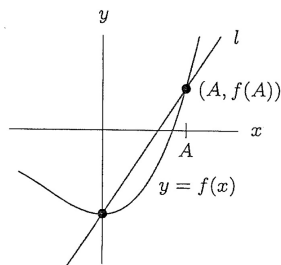
- (a) 7600 (b) 7000 (c) 6600 (d) 5800 (e) 8800

3. Find the implied domain D and range R for the function $f(x) = e^{\sin x}$

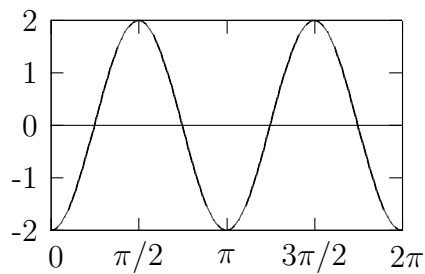
- (a) $D = [\frac{1}{e}, e], R = \mathbb{R}$
- (b) $D = [0, \infty], R = \mathbb{R}$
- (c) $D = \mathbb{R}, R = [0, \infty]$
- (d) $D = [-\frac{\pi}{2}, \frac{\pi}{2}], R = [-1, 1]$
- (e) $D = \mathbb{R}, R = [\frac{1}{e}, e]$

4. An equation for the line in the figure is $y =$

- (a) Ax
- (b) $\frac{f(A) - f(0)}{A}x + f(0)$
- (c) $(f(0) - f(A))x + A$
- (d) $xf(A) - A$
- (e) $f(0)x + f(A)$



5. Determine the function that corresponds to the following graph.



- (a) $2 \cos(2\theta + \pi/2)$
- (b) $2 \sin(2\theta)$
- (c) $\cos(2\theta)$
- (d) $2 \sin(2\theta - \pi/2)$
- (e) $\sin(\theta - \pi/2)$

6. If $x^2 + y^2 = 10$ and $x^2 - y^2 = 1$, then find the value of $|xy|$.

(a) $\frac{3\sqrt{11}}{2}$

(b) 3

(c) $3\sqrt{3}$

(d) $21/3$

(e) $\frac{2\sqrt{11}}{3}$

7. Given that r is the radius of a circle, d is the diameter, and c is the circumference, which of the following does *not* give the area of the circle?

(a) πr^2

(b) $\frac{1}{4}\pi d^2$

(c) $\frac{c^2}{4\pi}$

(d) cr

(e) $\frac{1}{2}\pi rd$

8. Find a value of δ for which $\sin(\theta + \delta) = -\cos(\theta + \frac{\pi}{3})$.

(a) $\delta = \pi$

(b) $\delta = \pi/2$

(c) $\delta = \pi/3$

(d) $\delta = 2\pi/3$

(e) $\delta = -\pi/6$

9. Solving $3^{x-2} = 81^{\frac{x}{6}}$ for x yields $x =$

(a) 4

(b) 2

(c) 0

(d) 7

(e) 6

10. Which of the following is a well-defined real number?

(a) $\sec \frac{\pi}{2}$

(b) $e^{\pi i}$

(c) $\sqrt{-25}$

(d) $\sin^{-1}(2)$

(e) $\ln(-7)$

11. If the radius of a circle is increased by 12%, by approximately what percentage is the area increased?

- (a) 12% (b) 25% (c) 1.2% (d) 2.5% (e) $\pi\%$

12. If we expand $(x + y)^{14}$, then the coefficient of $x^{12}y^2$ is

- (a) 364 (b) 13 (c) 91 (d) 14 (e) 1

13. If $f(x) = \frac{x}{x-1}$, find $(f \circ f)(x)$, assuming $x \neq 1$.

- (a) x
(b) $x(x - 1)$
(c) $\frac{x^2}{(x-1)^2}$
(d) $\frac{x}{2x+1}$
(e) $1 - \frac{1}{x}$
(f) $\frac{x^2}{x-1}$

14. What is the domain of the following function?

$$f(x) = \log_x(2 - 3x)$$

- (a) $(-\infty, 1) \cup (1, \frac{3}{2})$
(b) $[-\frac{2}{3}, 0) \cup (0, \frac{2}{3})$
(c) $[0, \frac{2}{3}]$
(d) $(0, \frac{2}{3})$
(e) $(0, 1) \cup (1, \frac{2}{3})$

15. Find the sum of the series $\sum_{n=2}^{\infty} \left(\frac{3}{4}\right)^n$.

- (a) $\frac{9}{4}$ (b) 4 (c) $\frac{4}{3}$ (d) 2 (e) 3

16. Find the multiplicative inverse of the complex number $2 - 3i$.

- (a) $\frac{1}{2} + \frac{1}{3}i$
- (b) $-2 + 3i$
- (c) $\frac{2}{13} + \frac{3}{13}i$
- (d) $\frac{5}{2} + \frac{5}{3}i$
- (e) $\frac{5}{2} - \frac{5}{3}i$

17. A sinusoidal function can be used to approximate the temperature of a chemical reaction as it oscillates between a low of 30°C and a high of 110°C . If it completes one cycle in a five-hour period with the lowest temperature at $t = 0$, a function that would model this activity is $f(t) =$

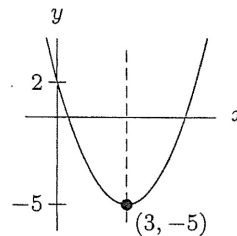
- (a) $-40 \cos(2\pi t/5) + 70$
- (b) $110 \cos t - 30$
- (c) $5 \cos t + 110$
- (d) $30 \cos 5t + 110$
- (e) $40 \cos 5t - 110$

18. Hank begins walking at 12:00 noon at a rate of 3 miles per hour. At 1:00 p.m., Betsy begins walking from the same spot at a rate of 4 miles per hour. If the angle between Hank's and Betsy's paths is 120° , how far apart are they at 3:00 p.m. (to the nearest mile)?

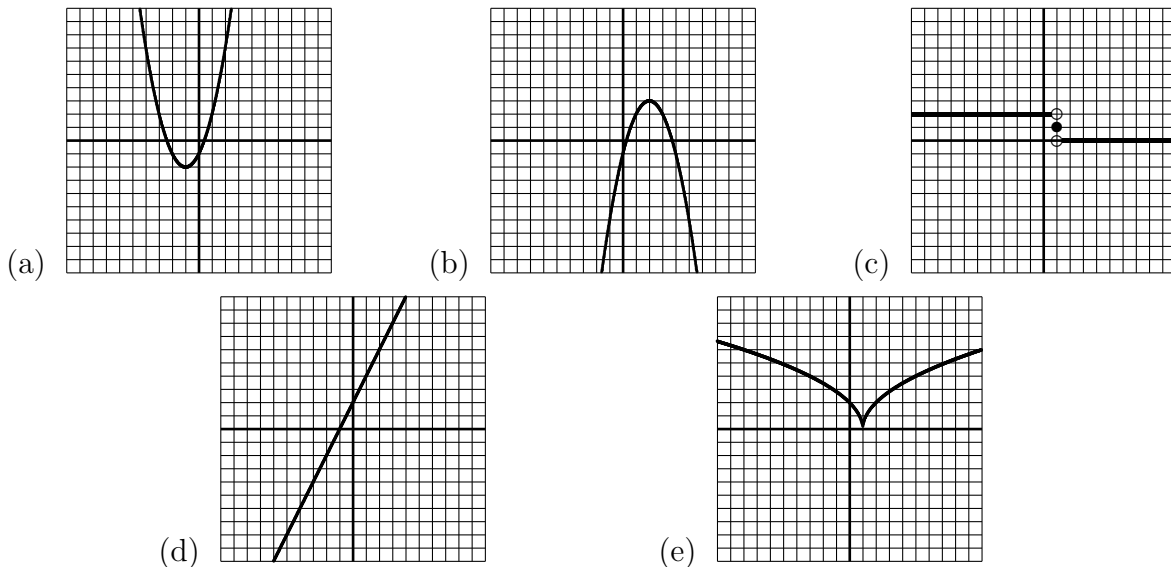
- (a) 12 miles (b) 13 miles (c) 15 miles (d) 17 miles (e) 18 miles

19. An equation for the parabola shown is $y =$

- (a) $3x^2 - 5$
- (b) $\frac{7}{9}x^2 - \frac{14}{3}x + 2$
- (c) $3x^2 - 5x + 2$
- (d) $\frac{3}{5}x^2 + 2$
- (e) $-\frac{5}{3}x^2 + 2$



20. Define $f(k)$ to be the number of real roots of $g(x) = x^2 + 2x + k$. Which of the following is the graph of $y = f(x)$?



21. Suppose that θ is a second-quadrant angle and that $\sin \theta = \frac{7}{25}$. Find $\sin 2\theta$

- (a) $\frac{14}{25}$ (b) $\frac{14}{625}$ (c) $\frac{336}{625}$ (d) $-\frac{336}{625}$ (e) $\frac{527}{625}$

22. The half-life of iodine-131 is 8 days. Approximately how long will it take for $\frac{2}{3}$ of an initial mass of iodine-131 to decay?

- (a) 12.7 days (b) 10.7 days (c) 9.3 days (d) 4.7 days (e) 2.3 days

23. Which best approximates the obtuse angle in a triangle with sides of length 5, 7, and 10?

- (a) 109° (b) 110° (c) 111° (d) 112° (e) 113°

24. The third term in an arithmetic sequence is 11 and the eighth term is 31. What is the sum of the first 10 terms of the sequence?

- (a) 35 (b) 39 (c) 43 (d) 136 (e) 210

25. The graph of $y = \frac{-x^3 + 2x + 1}{x^2 + 2x + 1}$ has an oblique asymptote at

- (a) $y = -1$ (b) $y = -x + 2$ (c) $y = -x$ (d) $y = -x - 1$ (e) $y = x$

26. A Ferris wheel is 20m in diameter and makes one revolution every 4 minutes. For about how many minutes of any revolution will your seat be above 15m?

- (a) 1.1 (b) 1.2 (c) 1.3 (d) 1.4 (e) 1.5

27. Simplify the following expression.

$$x^{(\log_x y)(\log_y 3)+2(\log_x y)(\log_y x)+\log_x y}$$

You may assume that x and y have values for which the expression is defined.

- (a) $y^2 x^{\log_y 3}$
(b) $x^2 3^{\log_y x}$
(c) $3x^2 y$
(d) $y^{\log_y 3+2\log_y x}$
(e) This expression is already in its simplest form.

28. Solve for x : $3^x = 6^{x+3}$

- (a) $x = 3 \log 6 - \log 2$
(b) $x = 6$
(c) $x = 3$ or $x = -3$
(d) $x = -3 \log_2 6$
(e) $x = \frac{-3}{\ln 2}$

29. The quadratic function that has x -intercepts at 1 and 4 and goes through the point (2,4) also goes through which of the following points?

- (a) (0, -1) (b) (5, -8) (c) (3, 5) (d) (5, -5) (e) (0, 3)

30. The Carson County High School Math Team consists of five boys and six girls. In how many different ways can a competition team of four students be chosen, given that it must contain at least one boy and at least one girl?

- (a) 150 (b) 160 (c) 310 (d) 330 (e) 600

31. If $3^a = 4^b = 6$, find the value of $\frac{2}{a} + \frac{1}{b}$.

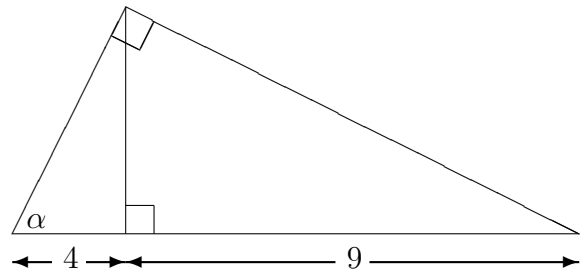
- (a) 1 (b) 2 (c) 3 (d) 4 (e) none of these

32. Solving $\left(\frac{x}{2} + 4\right)^{\frac{1}{2}} = (2x + 8)^{\frac{1}{3}}$ for x yields $x =$

- (a) 0, 3, 7 (b) 0, $\pm\sqrt{5}$ (c) 0, $4 \pm 4\sqrt{5}$ (d) 6, ± 2 (e) 0, $4 + 4\sqrt{5}$

33. Find $\tan \alpha$ in the given diagram:

- (a) $\frac{2}{3}$
 (b) $\frac{3}{2}$
 (c) $\frac{\sqrt{13}}{2}$
 (d) $\frac{2\sqrt{13}}{13}$
 (e) $\frac{4}{9}$



34. Find the (approximate) shortest distance between the point $(4, 4)$ and the line $2x + 5y = 10$.

- (a) 3.2875
 (b) 3.3425
 (c) 3.3575
 (d) 3.3825
 (e) 3.4175

35. Let A be a 2×2 matrix. If $A \begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $A \begin{bmatrix} 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, then find $A^{-1} \begin{bmatrix} 1 \\ 2 \end{bmatrix}$.

(a) $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

(b) $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$

(c) $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$

(d) $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$

(e) $\begin{bmatrix} 4 \\ 5 \end{bmatrix}$

36. The inequality:

$$||x + 2| - |x - 2|| > 1$$

has the same solution set as:

(a) $|x| > 1$

(b) $|x| > \frac{1}{2}$

(c) $|x| > 4$

(d) $|x| < 2$

(e) $|x| > 2$

37. A circle is centered at $(2, -3)$ and passes through the point $(-3, 4)$. Find the equation of the line tangent to the circle at $(-3, 4)$

(a) $7x + 5y + 1 = 0$

(b) $5x - 7y - 11 = 0$

(c) $5x - 7y + 43 = 0$

(d) $7x - 5y = 0$

(e) $5x + 7y - 41 = 0$

38. Given that $3 + i$ is a root of $f(x) = x^4 - 8x^3 + 14x^2 + 28x - 80$, find the sum of the real roots of f

(a) 2

(b) -2

(c) 8

(d) -8

(e) There are no real roots of f

39. Suppose a farmer transports some produce down a 24 mile stretch of river. His boat takes one hour longer to make the return journey than it did going down. Assuming that the boat's speed relative to the water is constant, and that the current is 3 miles per hour, how long does the entire trip take?

- (a) 3.57 hours
- (b) 3.95 hours
- (c) 4.12 hours
- (d) 4.30 hours
- (e) 4.39 hours

40. Find the coefficient of the first-degree term in the expansion of $(3x + \frac{1}{x})^7$

- (a) 945 (b) 1701 (c) 2835 (d) 11340 (e) 17010