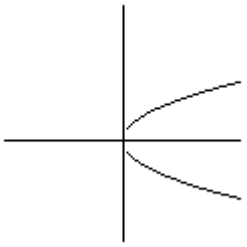
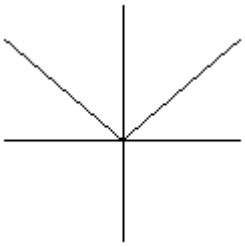
1. **Which of the following graphs is <u>not</u> the graph of a function?**

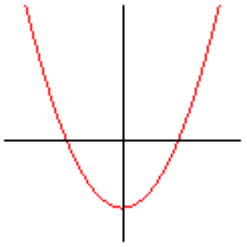
(a)



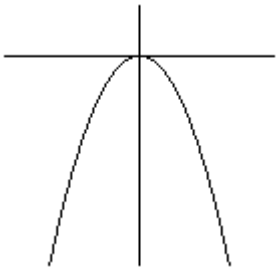
(b)



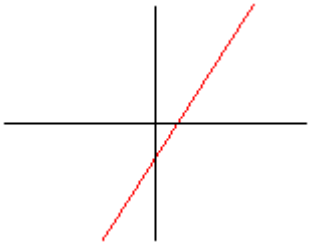
(c)



(d)



(e)



2. **Find the domain D and range R of the function $f(x) = x^2 + 4x + 22$.**

   (a) $D = \{ x \mid x \geq 2\}$

   $R = \{ y \mid y \geq 18\}$

   (b) $D = \{ x \mid x$ is any real number$\}$

   $R = \{ y \mid y$ is any real number$\}$

   (c) $D = \{ x \mid x$ is any real number$\}$

   $R = \{ y \mid y \geq 18\}$

   (d) $D = \{ x \mid x \geq -2\}$

   $R = \{ y \mid y \geq 18 \}$

   (e) $D = \{ x \mid x$ is any real number$\}$

   $R = \{ y \mid y \geq 22\}$

3. **How many x-intercepts does the graph of the polynomial**

   $p(x) = (x - 2)(x + 3)(x - 15)^2(x^2 + 4)$ have?

   (a) six

   (b) five

   (c) four

   (d) three

   (e) two

4. **The graph of which of the following functions will be the graph of $y = x^2$ shifted two units to the right and then reflected about the x-axis?**

   (a) $y = -(x^2 - 2)$

   (b) $y = -x^2 - 2$

   (c) $y = -(x + 2)^2$

   (d) $y = (-x - 2)^2$

   (e) $y = -(x - 2)^2$

5. **For $a > 0$ and $b > 0$, which of the following is equal to $3(\ln a) - 2(\ln b)$?**

   (a) $\ln(3a - 2b)$

   (b) $\ln(a^3 - b^2)$

   (c) $\ln\left(\frac{a^3}{b^2}\right)$

   (d) $\frac{\ln(a^3)}{\ln(b^2)}$

   (e) $\ln\left(\frac{3a}{2b}\right)$

6. **If $f(x) = 3x - 5$, then**

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

   (b) $f^{-1}(x) = -3x + 5$

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

   (d) $f^{-1}(x) = \frac{1}{3}x - \frac{1}{5}$

   (e) $f^{-1}(x) = \frac{1}{3x - 5}$

7. **The angle θ is an acute angle and $\sin\theta = 0.7021$. What is the measure of θ to the nearest minute?**

   (a) 65° 14′

   (b) 54° 56′

   (c) 45° 24′

   (d) 44° 36′

   (e) 35° 4′

8. **From a point 12 feet from the base of a flag pole the angle of elevation to the top of the flag pole is 58.3°. What is the height (to the nearest foot) of the flag pole?**

   (a) 24 feet

   (b) 19 feet

   (c) 12 feet

   (d) 11 feet

   (e) 10 feet

9. **A lighthouse is located 200 miles from a port on a bearing of S 50° E. A ship is located 25 miles due south of the port. How far is the ship from the lighthouse?**

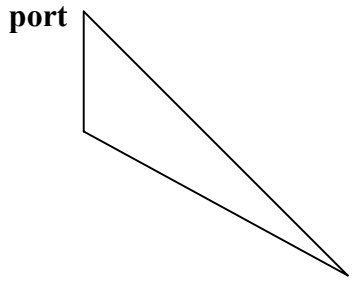
   (a) 153 miles

   (b) 182 miles

   (c) 185 miles

   (d) 217 miles

   (e) 220 miles



10. Given A is a 3 × 3 matrix, B is a 4 × 3 matrix, and C is a 3 × 4 matrix, which of the following matrix products is <u>not</u> defined?

(a) BC

(b) BA

(c) CB

(d) AC

(e) CA

11. Given $f(x) = \dfrac{5x+9}{x+1}$ and $g(x) = x^2 - 1$, find $(f \circ g)(-2)$.

(a) 4

(b) 6

(c) 0

(d) 3

(e) –2

12. If $f(x) = 3x + 11$, what is the value of $(f^{-1} \circ f)(2)$?

(a) $\dfrac{1}{17}$

(b) -17

(c) 1

(d) 2

(e) 62

13. According to Descartes' rule of signs, what can you say about the real zeros of the polynomial $p(x) = 4x^5 - 3x^4 + 5x^3 + 2x - 7$

(a) there are 3 or 1 positive real zeros and no negative real zeros

(b) there are 5 or 3 or 1 positive real zeros and no negative real zeros

(c) there are 2 or 0 positive real zeros and 3 or 1 negative real zeros

(d) there are 3 or 1 positive real zeros and 2 or 0 negative real zeros

(e) there are 2 or 0 positive real zeros and 2 or 0 negative real zeros

14. A bacteria culture is growing according to the law $A = A_0e^{0.0438t}$ where A_0 is the initial amount of the culture present in grams and A is the amount present after t hours. If the culture initially contains 3 grams, how much of the culture (to the nearest hundredth) will be present after 8 hours?

(a) 1.42 grams

(b) 4.26 grams

(c) 25.07 grams

(d) 42.85 grams

(e) 99.74 grams

15. Which of the following functions is <u>not</u> an increasing function?

(a) $y = 4^x$

(b) $y = e^{3x}$

(c) $y = 3x + 1$

(d) $y = \ln(x^3)$

(e) $y = \sqrt{4 - x}$

16. Which of the following products will yield a third degree polynomial with real coefficients and have $\frac{1}{2}$ and $1 - 2i$ as zeros?

(a) $(x - \frac{1}{2})(x - 1 - 2i)(x + 1 - 2i)$

(b) $(x - \frac{1}{2})(x - 1 + 2i)(x + 1 - 2i)$

(c) $(x - \frac{1}{2})(2x + 1)(x - 1 + 2i)$

(d) $(x - \frac{1}{2})(x - 1 + 2i)(x - 1 - 2i)$

(e) $(x + \frac{1}{2})(x - 1 - 2i)(x - 1 + 2i)$

17. Which of the following intervals is the <u>range</u> of the function $y = e^x - 5$?

(a) $(-\infty, \infty)$

(b) $(-5, \infty)$

(c) $(3, \infty)$

(d) $(5, \infty)$

(e) $(-2, \infty)$

18. The quantity supplied Q_s and the quantity demanded Q_d of toasters are given by the equations

$$Q_s = 35p - 700$$

$$Q_d = 800 - 15p$$

where p is the price. The equilibrium price of a market is defined as the price at which quantity supplied equals quantity demanded ($Q_s = Q_d$). The equilibrium price for toasters is

(a) $20.00

(b) $25.00

(c) $30.00

(d) $45.00

(e) $60.00

19. What power function will the graph of the polynomial

$p(x) = x^2(x - 15)^3(x + 3)^2(x - 13)$ resemble for large values of $|x|$?

(a) $y = x^4$

(b) $y = x^5$

(c) $y = x^6$

(d) $y = x^7$

(e) $y = x^8$

20. Which of the following is an appropriate next step in the row reduction of the matrix $\begin{bmatrix} 1 & 3 & -2 & 5 \\ 0 & 1 & -1 & -2 \\ 0 & 3 & 3 & 5 \end{bmatrix}$?

(a) Multiply row two by three and add it to row three

(b) Multiply row two by negative three and add it to row three

(c) Multiply row one by negative one and add it to row three

(d) Multiply row two by three and add it to row one

(e) Multiply row two by negative two and add it to row three

21. The graph of $p(x) = x(x - 15)^2(x + 3)^3(x - 13)$ crosses the x-axis at which of its x-intercepts?

(a) (0, 0) and (–3, 0)

(b) (0, 0), (15, 0), and (–3, 0)

(c) (15, 0) and (13, 0)

(d) (0, 0), (–3, 0), and (13, 0)

(e) (15, 0) and (–3, 0)

22. Let $A = \begin{bmatrix} 3 & 2 \\ 5 & 4 \end{bmatrix}$. What is A^{-1}?

(a) $A^{-1} = \begin{bmatrix} \frac{1}{3} & \frac{1}{2} \\ \frac{1}{5} & \frac{1}{4} \end{bmatrix}$

(b) $A^{-1} = \begin{bmatrix} \frac{3}{2} & 1 \\ \frac{5}{2} & 2 \end{bmatrix}$

(c) $A^{-1} = \begin{bmatrix} 2 & -1 \\ \frac{-5}{2} & \frac{3}{2} \end{bmatrix}$

(d) $A^{-1} = \begin{bmatrix} 4 & -2 \\ -5 & 3 \end{bmatrix}$

(e) $A^{-1} = \begin{bmatrix} -3 & -2 \\ -5 & -4 \end{bmatrix}$

23. All of the <u>vertical and horizontal asymptotes</u> to the graph of

$y = \dfrac{(x-3)(x+2)}{(x+8)(x+3)}$ **are**

(a) $x = 3$ **and** $x = -2$

(b) $x = -8$ **and** $x = -3$

(c) $x = 3$, $x = -2$, **and** $y = 1$

(d) $x = -8$, $x = -3$, **and** $y = 1$

(e) $x = -8$, $x = -3$, **and** $y = -1$

24. The x-intercepts to the graph of $y = \dfrac{(x+2)(x-1)(x-3)}{(x+1)(x-2)(x^2+3)}$ **will be**

(a) (1, 0), (3, 0), and (–2, 0)

(b) (–1, 0), (–3, 0), and (2, 0)

(c) (0, 0), (1, 0), and (2, 0)

(d) (2, 0) and (–1, 0)

(e) (2, 0), (1, 0), and (–2, 0)

25. Solve the equation $\log_2(5x + 3) = 5$ **for x.**

(a) x = 0.4

(b) x = 0.8

(c) x = 4.4

(d) x = 5.8

(e) x = 6.0

26. What is the interest rate (to the nearest hundredth of a percent) if an investment of $1300 earning interest compounded continuously is worth $1629.65 at the end of 5 years?

(a) 25.36%

(b) 15.96%

(c) 10.47%

(d) 5.07%

(e) 4.52%

27. F(x) is a polynomial with integer coefficients. The constant term in F(x) is 20 and the leading coefficient of F(x) is 45. Which of the following could be a rational zero of F(x)?

(a) 9

(b) -3

(c) $\frac{1}{2}$

(d) $\frac{3}{10}$

(e) $\frac{4}{9}$

28. If revenue is given by $R = 350x - 0.07x^2$ where x is the number of units produced, find the value of x that yields the maximum revenue.

(a) 2000

(b) 2500

(c) 3500

(d) 5000

(e) 15000

29. How is the graph of $y = \frac{1}{x-4} + 3$ related to the graph of $y = \frac{1}{x}$?

(a) it is the graph of $y = \frac{1}{x}$ shifted four units to the right and three units up

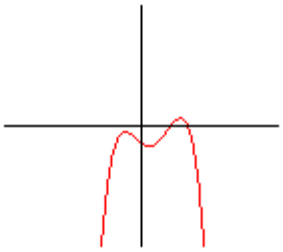
(b) it is the graph of $y = \frac{1}{x}$ shifted four units to the left and three units up

(c) it is the graph of $y = \frac{1}{x}$ shifted four units up and three units right

(d) it is the graph of $y = \frac{1}{x}$ shifted four units down and three units right

(e) it is the graph of $y = \frac{1}{x}$ shifted four units down and three units left

30. The graph shown below is the graph of a polynomial q(x). All x-intercepts are shown in the graph. Which of the following statements describes the polynomial q(x)?



(a) q(x) is an odd degree polynomial with a negative constant term

(b) q(x) is an odd degree polynomial with a positive leading coefficient

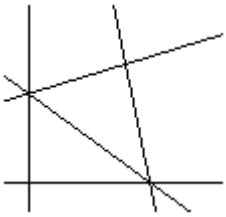
(c) q(x) is an even degree polynomial with a negative leading coefficient

(d) q(x) is an even degree polynomial with a positive constant term

(e) q(x) is an even degree polynomial with a positive leading coefficient

31. The triangular region shown below is determined by the system of inequalities

$$\begin{cases} x - 4y \geq -12 \\ 20 - 4x \geq y \\ 3x + 5y \geq 15 \end{cases}$$



The corners of this region are (4, 4), (5, 0), and (0, 3).

What is the minimum value of z = 4x + 5y if x and y satisfy this system of inequalities?

(a) 36

(b) 20

(c) 15

(d) 8

(e) –6

32. Let $f(x) = \begin{cases} 5x - 4 & \text{if } x < 3 \\ x^2 + 5 & \text{if } x \geq 3 \end{cases}$ **. Then**

(a) f(2) is undefined and f(3) = 14

(b) f(2) = 6 and f(3) = 14

(c) f(2) = 9 and f(3) = 14

(d) f(2) is undefined and f(3) = 11

(e) f(2) = 9 and f(3) = 11

33. The value of the determinant $\begin{vmatrix} 2 & 3 & -2 \\ 4 & 0 & -1 \\ -1 & 5 & 3 \end{vmatrix}$ **is**

(a) –63

(b) –48

(c) –33

(d) 28

(e) 58

34. What is the domain of the logarithm function y = ln(2x – 5)?

(a) x > 5

(b) x > 3

(c) x > 2.5

(d) x < 2.5

(e) x < 3

35. The lengths of the sides of a right triangle are 5, 12, and 13 units. The measures (to the nearest degree) of the acute angles of this triangle are

(a) 7° and 83°

(b) 21° and 69°

(c) 23° and 67°

(d) 25° and 65°

(e) 30° and 60°

36. The value of $\log_5(27)$ is approximately equal to

(a) 0.4883

(b) 1.4314

(c) 2.0013

(d) 2.0478

(e) 3.2958

37. The length of a box is three times its width and the height of the box is two units more than its width. If we let x represent the width of the box, which of the following functions could be used to calculate the volume of the box?

(a) $V(x) = 2x^2(x + 3)$

(b) $V(x) = 3x(x + 2)$

(c) $V(x) = 3x(x + 3)$

(d) $V(x) = 3x^2(x + 2)$

(e) $V(x) = x(x + 3)(x + 2)$

38. If $A = \begin{bmatrix} 3 & -2 \\ 5 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ 0 & 5 \end{bmatrix}$, then $3A - 7B =$

(a) $\begin{bmatrix} -5 & -1 \\ 5 & -1 \end{bmatrix}$

(b) $\begin{bmatrix} 7 & -5 \\ 15 & 7 \end{bmatrix}$

(c) $\begin{bmatrix} -11 & 5 \\ 5 & -31 \end{bmatrix}$

(d) $\begin{bmatrix} 23 & -13 \\ 15 & 47 \end{bmatrix}$

(e) $\begin{bmatrix} -5 & 1 \\ 15 & -23 \end{bmatrix}$

39. In a right triangle, the length of the hypotenuse is 40 inches and the length of one of the legs is 9 inches. The tangent and cotangent of one of the acute angles in the triangle are

(a) $\frac{9}{40}$ and $\frac{40}{9}$

(b) $\frac{9}{41}$ and $\frac{41}{9}$

(c) $\frac{\sqrt{1519}}{40}$ and $\frac{40}{\sqrt{1519}}$

(d) $\frac{\sqrt{1519}}{9}$ and $\frac{9}{\sqrt{1519}}$

(e) $\frac{\sqrt{1519}}{41}$ and $\frac{41}{\sqrt{1519}}$

40. If A is a 3×3 invertible matrix, then

(a) $\mathbf{A \cdot A^{-1}} = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

(b) $\mathbf{A \cdot A^{-1}} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

(c) $\mathbf{A \cdot A^{-1}} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

(d) $\mathbf{A \cdot A^{-1}} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(e) $\mathbf{A \cdot A^{-1}}$ **cannot be determined without knowing the entries in A**