Sample Placement Exam

Algebra

1. Factor $4x^2 - 9y^2$.

   (a) $4x^2 - 9y^2$
   (b) $(2x - 3y)^2$
   (c) $(2x + 3y)^2$
   (d) $(4x - 9y)(4x + 9y)$
   (e) $(2x - 3y)(2x + 3y)$

2. Expand $(3x + 2)^2$.

   (a) $9x^2 + 12x + 4$
   (b) $9x^2 + 4$
   (c) $6x + 4$
   (d) $9x^2 - 4$
   (e) $9x^2 + 6x + 4$

3. Simplify $\left(\dfrac{2x}{y^2}\right)^3$.

   (a) $\dfrac{2x^3}{y^6}$
   (b) $\dfrac{6x}{y^2}$
   (c) $\dfrac{8x^3}{y^6}$
   (d) $\dfrac{8x^4}{y^5}$
   (e) $\dfrac{6x^3}{y^6}$

4. Simplify $\dfrac{2x^2 - x - 3}{x^2 - 1}$.

   (a) $\dfrac{2x + 3}{x + 1}$
   (b) $x + 1$
   (c) $\dfrac{2x - 3}{x - 1}$
   (d) $x + 3$
   (e) $\dfrac{2x^2 - x - 3}{x^2 - 1}$

5. Solve the following system:

$$\begin{aligned} 2x + 3y &= -5 \\ x + y &= -1 \end{aligned}$$

   (a) $\left(-\frac{8}{5}, -\frac{3}{5}\right)$

(b) $\left(-\frac{2}{5}, -\frac{7}{5}\right)$
(c) $(-3, 2)$
(d) $(2, -3)$
(e) no solution

6. Solve $2x + \frac{1}{3} = \frac{1}{2}x - 1$.

(a) $x = -\frac{8}{9}$
(b) $x = -\frac{8}{15}$
(c) $x = -\frac{4}{9}$
(d) $x = -\frac{4}{15}$
(e) $x = -2$

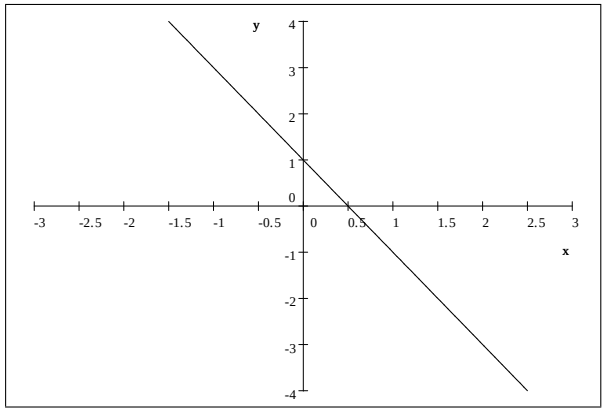
7. Solve $|x - 1| \leq 10$.

(a) $-9 < x < 11$
(b) $-9 \leq x \leq 11$
(c) $x \leq 11$
(d) $x \leq -9$ or $x \geq 11$
(e) $x \leq 9$

8. Simplify $\sqrt[3]{16b^4} + \sqrt[3]{2b}$

(a) the expression is already simplified
(b) $4b\sqrt[3]{b} + \sqrt[3]{2b}$
(c) $2b\sqrt[3]{4b^2}$
(d) $4b^2 + \sqrt[3]{2b}$
(e) $(2b + 1)\sqrt[3]{2b}$

9. Find the equation of the graph given below.



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

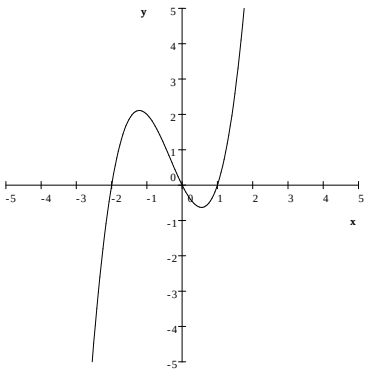
10. Find the equation of the line parallel to $2x - y = 2$ that passes through $(1, 4)$.

    (a) $y - 4 = -\frac{1}{2}(x - 1)$
    (b) $y - 1 = -2(x - 4)$
    (c) $y - 1 = 2(x - 4)$
    (d) $y - 4 = 2(x - 1)$
    (e) $y + 4 = 2(x + 1)$

11. Find the zeros of f where $f(x) = \left(x^2 - 4\right)(2x + 8)$.

    (a) -32
    (b) $2, 4$
    (c) $-2, 2, 4$
    (d) $-4, 2$
    (e) $-4, -2, 2$

12. Use the graph of $g(x) = x^3 + x^2 - 2x$ shown below to find the solution set of $x^3 + x^2 > 2x$.



    (a) $(0, 1)$
    (b) $(-2, 0) \cup (1, \infty)$
    (c) $(-\infty, -2) \cup (0, 1)$
    (d) $(-2, 1)$
    (e) $(0, \infty)$

13. Find the distance between $(2, 3)$ and $(1, -6)$.

    (a) $3\sqrt{2}$
    (b) $\sqrt{82}$
    (c) 9
    (d) 10
    (e) $\sqrt{10}$

14. Solve $\dfrac{2}{x} + \dfrac{3}{x} = \dfrac{5}{3}$

    (a) $x = 3$
    (b) $x = \frac{18}{25}$

(c) $x = \frac{25}{3}$

(d) $x = \frac{3}{2}$

(e) $x = \sqrt{3}$

15. Find the x-intercepts of the parabola $y = x^2 - 6x - 7$.

(a) $(0, -7)$

(b) $\left(3 - \sqrt{2}, 0\right)$ and $\left(3 + \sqrt{2}, 0\right)$

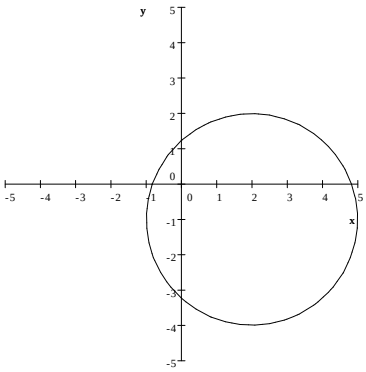
(c) $\left(-3 - \sqrt{2}, 0\right)$ and $\left(-3 + \sqrt{2}, 0\right)$

(d) $(1, 0)$ and $(-7, 0)$

(e) $(-1, 0)$ and $(7, 0)$

16. Identify the graph of $x^2 + y^2 - 4x + 2y - 4 = 0$

(a)



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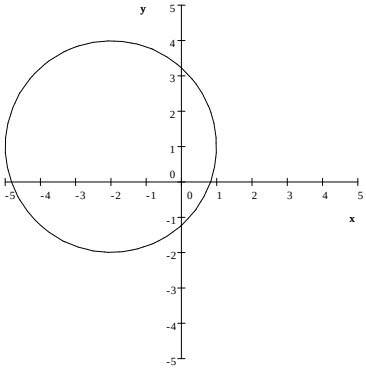

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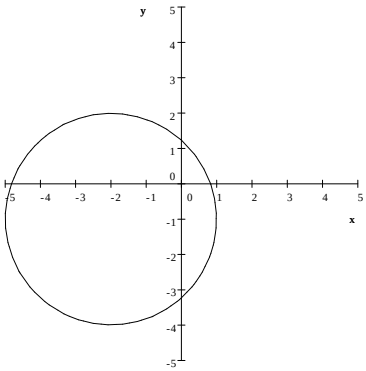

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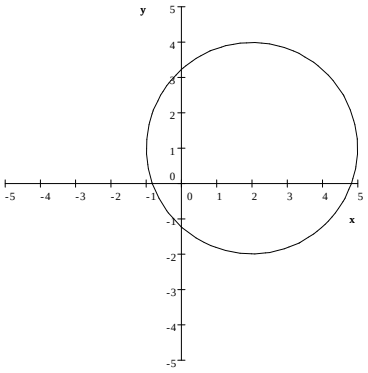

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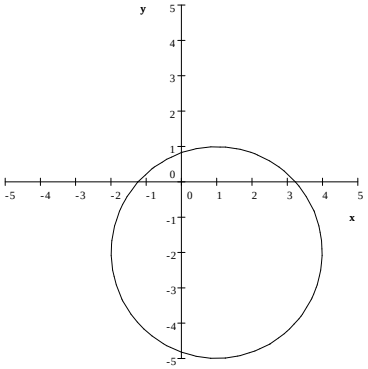


17. Solve $2x^2 + 6x - 3 = 0$

    (a) $x = \dfrac{-3 \pm \sqrt{15}}{2}$

    (b) $x = \dfrac{-3 \pm \sqrt{3}}{2}$

    (c) $x = \dfrac{3 \pm \sqrt{15}}{2}$

    (d) $x = -3 \pm \sqrt{15}$

    (e) $x = -3$ or $x = \frac{1}{2}$

18. Find the domain of $f(x) = \dfrac{x+4}{2x-6}$

    (a) All real numbers except 0

    (b) All real numbers except 3 and -4

    (c) All real numbers except 3

    (d) All real numbers except -4

    (e) All real numbers

19. Given that $f(x) = \frac{2}{x}$ and $g(s) = 3s - 5$, compute $f(g(t))$.

    (a) $\dfrac{2}{3t^2 - 5}$

    (b) $\dfrac{2}{t} + 3t - 5$

    (c) $6 - \dfrac{10}{t}$

(d) $\dfrac{6}{t} - 5$

(e) $\dfrac{2}{3t-5}$

20. Find the inverse $f^{-1}(x)$, where $f(x) = x^3 + 1$.

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

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

(c) $f^{-1}(x) = x^3 - 1$

(d) $f^{-1}(x) = x^{1/3} - 1$

(e) $f^{-1}(x) = (x-1)^{1/3}$

21. Solve $3^{2x+1} = \frac{1}{3}$.

(a) $x = -\frac{4}{9}$

(b) $x = -1$

(c) $x = 0$

(d) $x = -\frac{1}{9}$

(e) $x = -4$

22. Which of the following statements are true:

I. Every natural number is an integer.
II. Some integers are irrational numbers.
III. Some complex numbers are real.

(a) I only

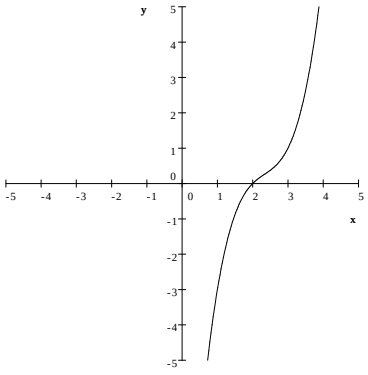
(b) I and III

(c) I and II

(d) II and III

(e) I, II, and III

23. Use the graph of $y = x^3 - 7x^2 + 17x - 14$ shown below to find the solution of $x^3 - 7x^2 = 14 - 17x$.



(a) $x = 2$

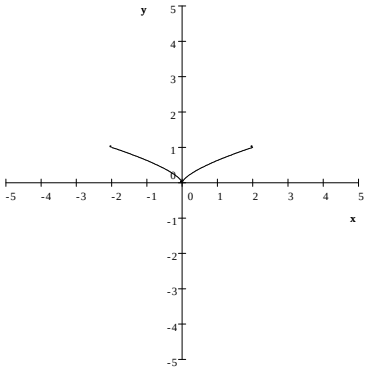
(b) $x = -2$

(c) $x = 0$

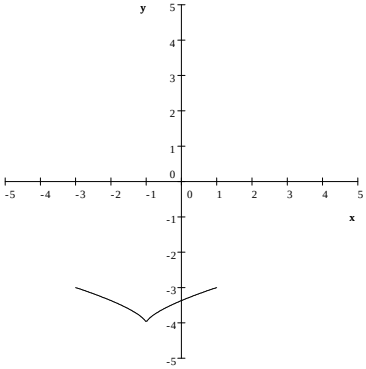
(d) $x = -14$

(e) $x = 2$ or $x = -2$

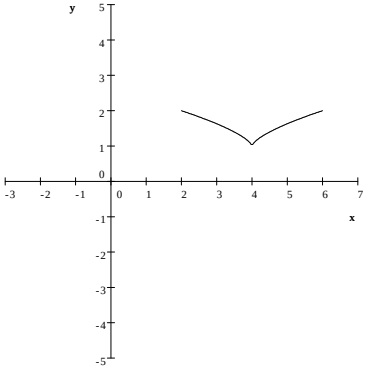
24. The graph of a function $f(x)$ is shown below. Identify the graph of $h(x) = f(x+1) - 4$.



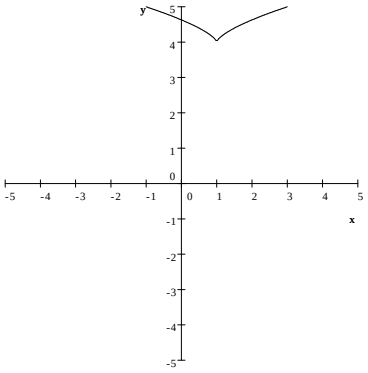
(a)



(b)



(c)



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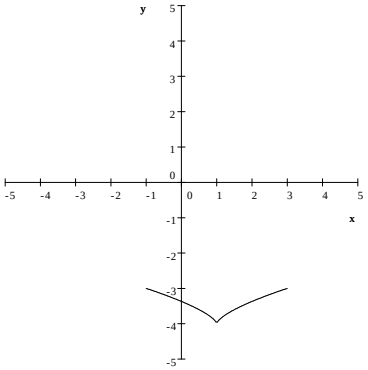

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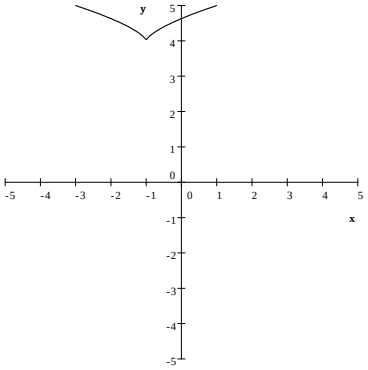
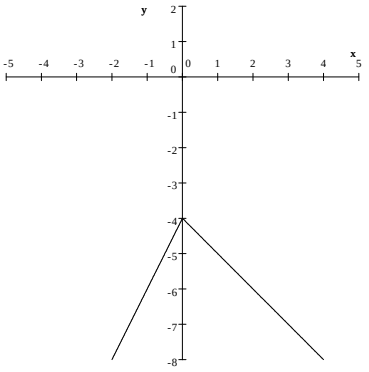
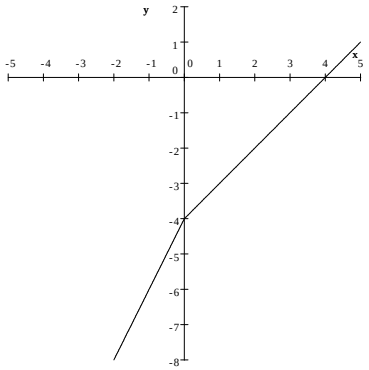


25. Sketch the graph of $f(x) = \begin{cases} -x-4 & \text{if} \quad x \leq 0 \\ 2x-4 & \text{if} \quad x > 0 \end{cases}$.

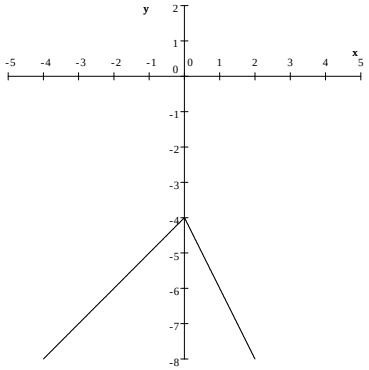
(a)



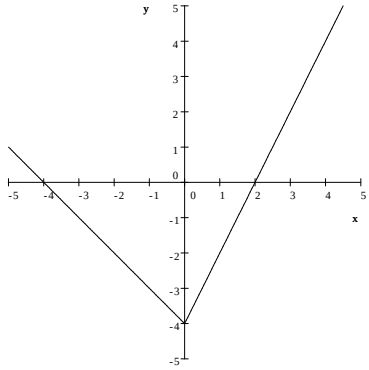
(b)



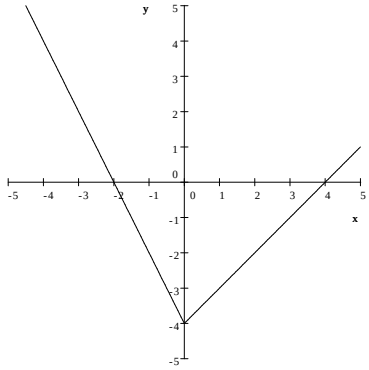
(c)



(d)



(e)



26. The function $C(x) = 10x^2 + 40x + 90$ gives the cost (in dollars) of producing x units of a product. Find the cost for producing the fourth unit.

    (a) \$110

(b) \$410

(c) \$120

(d) \$300

(e) \$320

27. Find the vertical asymptotes of $f(x) = \dfrac{1}{x^2 - 2x - 3}$

(a) $x = -\frac{1}{3}$

(b) $x = 0$

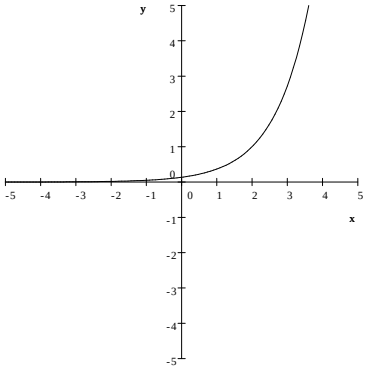
(c) $x = -1$ and $x = 3$

(d) $y = 0$

(e) none

28. Sketch the graph of $f(x) = e^{x+2}$.

(a)



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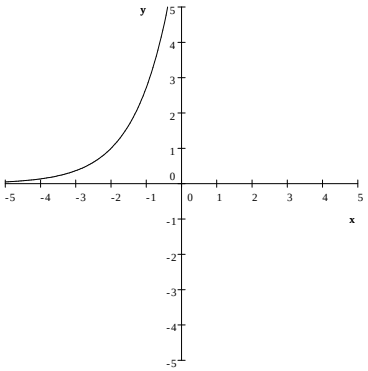

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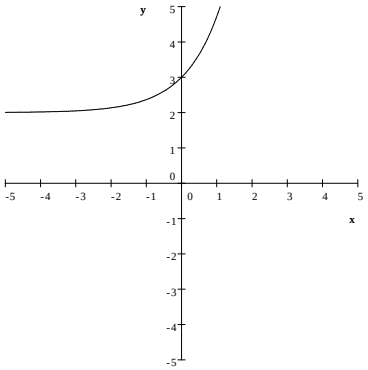
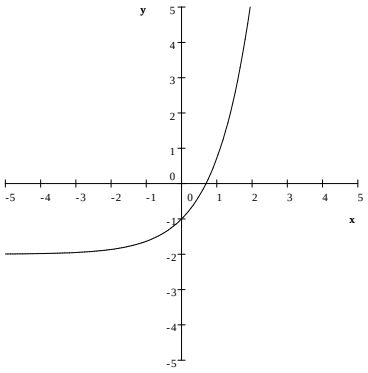


(d)



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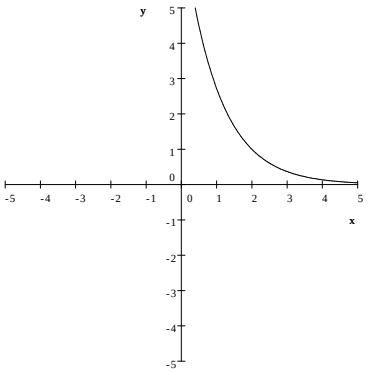


29. Evaluate $\log_2 16$

    (a) 8
    (b) $\frac{1}{8}$
    (c) $\frac{1}{4}$
    (d) -4
    (e) 4

30. Express $5\log x - 6\log y + 3\log z$ as a single logarithm.

    (a) $\log\left(\dfrac{x^5z^3}{y^6}\right)$
    (b) $\log(5x - 6y + 3z)$
    (c) $\log\left(x^5 - y^6 + z^3\right)$
    (d) $\log\left(\dfrac{x^5 + z^3}{y^6}\right)$
    (e) $\log\left(\dfrac{5xz}{2y}\right)$

31. The fastest growing city in the United States between the years 1980 and 1990 was Moreno Valley, California. The population was approximately 30,000 in 1980 and 120,000 in 1990. Assuming exponential growth (i.e. the population P as a function of the time t in years is $P = P_0e^{kt}$), what was the population in the year 1998.

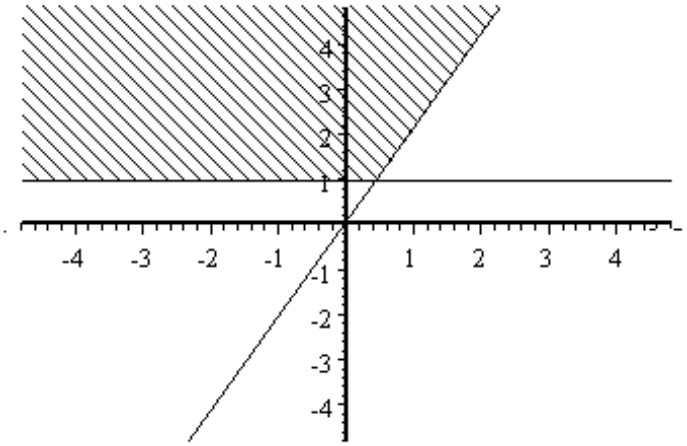
    (a) $e^{1.8\ln 90{,}000}$
    (b) $30,000e^{1.8\ln 90{,}000}$
    (c) $90,000e^{1.8\ln 4}$

(d) $120,000e^{1.8 \ln 4}$

(e) $30,000e^{1.8 \ln 4}$

32. Graph the system of inequalities $y \leq 1, x \geq \frac{1}{2}y$.

(a)



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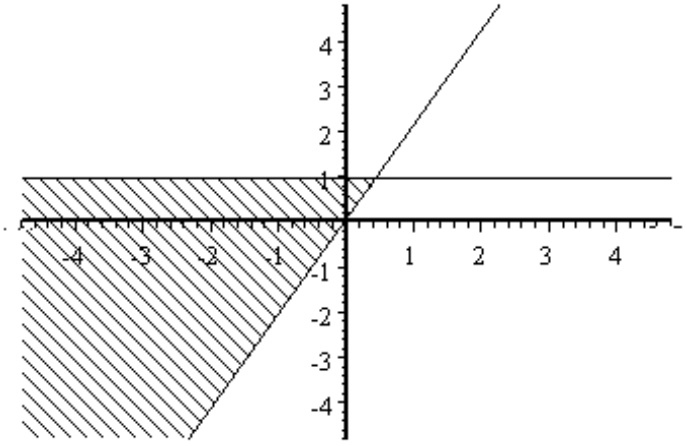

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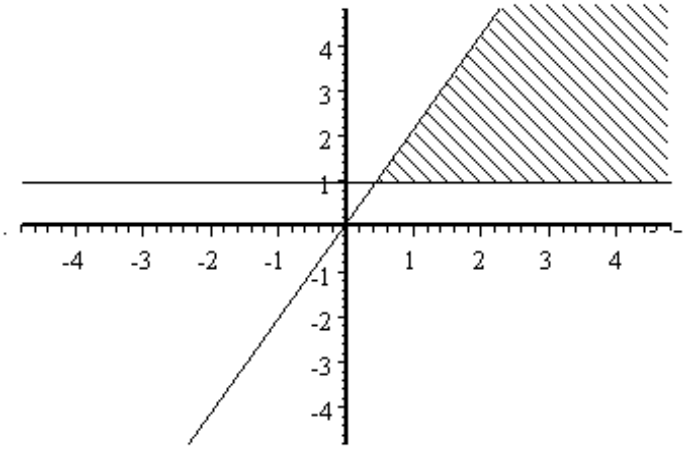

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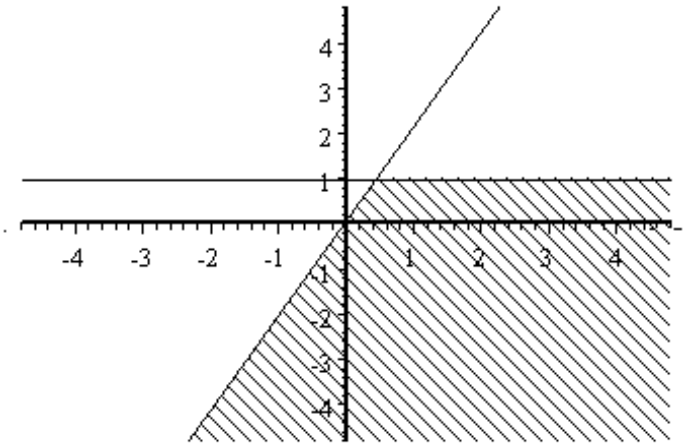

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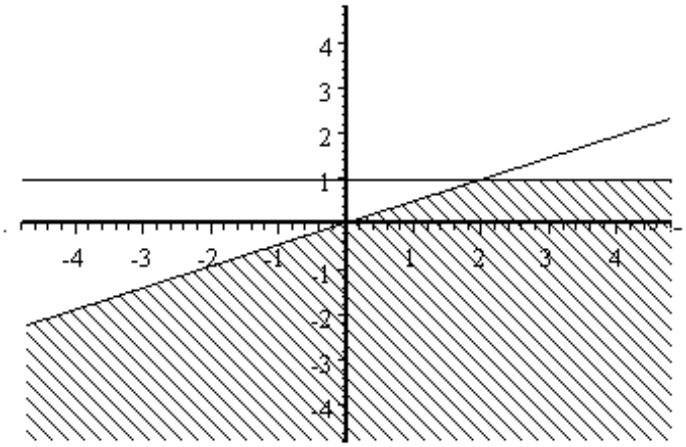


33. A budding numinsmatist (coin collector) has a total of 15 silver dollars and quarters; the total face value of the silver dollars and quarters is \$9.75. How many of each does he have?

    (a) 0 silver dollars and 39 quarters
    (b) 8 silver dollars and 7 quarters
    (c) 10 silver dollars and 5 quarters
    (d) 7 silver dollars and 8 quarters
    (e) no solution

Trigonometry

1. Find the exact degree measure of an angle of $\frac{5\pi}{6}$ radians.

    (a) $60\,^\circ$
    (b) $120\,^\circ$
    (c) $30\,^\circ$
    (d) $150\,^\circ$
    (e) none of the above

2. Find the radian measure of the central angle that subtends an arc of length 10π in a circle of radius 4.

(a) 40
(b) $\frac{5\pi}{2}$
(c) 40π
(d) $\frac{5}{2}$
(e) none of the above

3. Given that $\cos\theta = \frac{2}{5}$ and θ is an angle with terminal side in the fourth quadrant, find $\sin\theta$.

(a) $\frac{3}{5}$
(b) $-\frac{3}{5}$
(c) $\frac{\sqrt{21}}{5}$
(d) $-\frac{\sqrt{21}}{5}$
(e) none of the above

4. Compute $\csc\frac{5\pi}{4}$.

(a) $\sqrt{2}$
(b) $-\frac{\sqrt{2}}{2}$
(c) $-\sqrt{2}$
(d) 1
(e) none of the above

5. Find $\sin 2\theta$ if $\tan\theta = \frac{3}{4}$.

(a) $\frac{6}{5}$
(b) $\frac{8}{5}$
(c) $\frac{24}{25}$
(d) $\frac{16}{25}$
(e) none of the above

6. Find the amplitude and period of $f(x) = -2\cos 3x$.

(a) Amplitude -2, period 3
(b) Amplitude 2, period 3π
(c) Amplitude 2, period $\frac{2\pi}{3}$
(d) Amplitude 3, period 2π
(e) none of the above

7. Evaluate $\arctan(1)$.

(a) $\frac{\pi}{6}$
(b) 45°
(c) $\dfrac{\arcsin(1)}{\arccos(1)}$
(d) 1
(e) none of the above

8. From a point on the ground 20 feet from the base of a flagpole, the angle of elevation to the top of the pole is $60\,^\circ$. How tall is the flagpole?

   (a) 10 feet
   (b) $20\sqrt{3}$ feet
   (c) $\frac{20\sqrt{3}}{3}$ feet
   (d) $10\sqrt{2}$ feet
   (e) none of the above

9. Find all solutions of $\frac{1}{2} + \sin x = 0$ on $[0, 2\pi)$.

   (a) $\left\{\frac{2\pi}{3}, \frac{4\pi}{3}\right\}$
   (b) $\left\{\frac{2\pi}{3}, \frac{5\pi}{3}\right\}$
   (c) $\left\{\frac{5\pi}{6}, \frac{7\pi}{6}\right\}$
   (d) $\left\{\frac{5\pi}{6}, \frac{11\pi}{6}\right\}$
   (e) none of the above

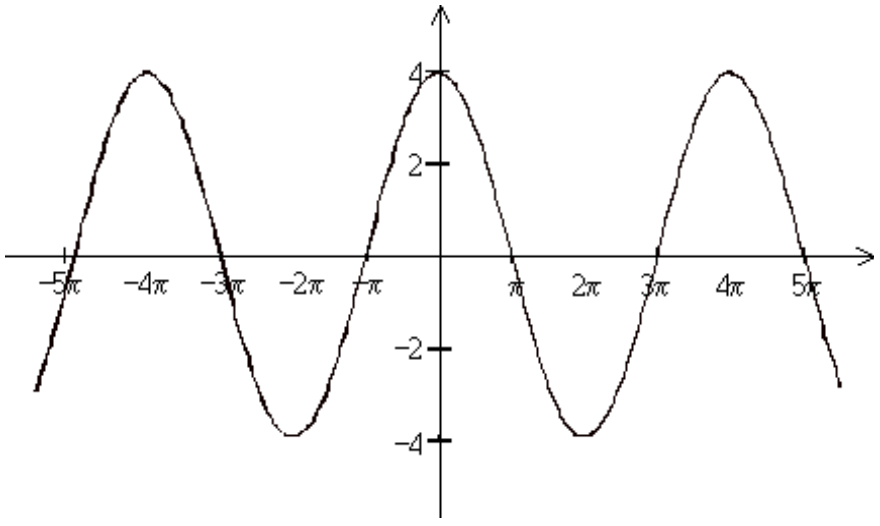
10. Which of the following equations is an identity?

    (a) $\sin x + \cos x = 1$
    (b) $\cos 2x = 2\cos x$
    (c) $\tan^2 x + 1 = \sec^2 x$
    (d) $\sec x = \dfrac{1}{\sin x}$
    (e) none of the above

11. Find all solutions of $\tan^2 x + \tan x = 0$ on $[0, 2\pi)$

    (a) $\{0, \pi\}$
    (b) $\left\{\frac{3\pi}{4}, \frac{7\pi}{4}\right\}$
    (c) $\left\{\frac{\pi}{4}, \frac{5\pi}{4}\right\}$
    (d) $\left\{0, \pi, \frac{3\pi}{4}, \frac{7\pi}{4}\right\}$
    (e) none of the above

12. Identify the function with the following graph.



(a) $f(x) = -4\sin\left(\frac{x}{2} - \frac{\pi}{2}\right)$

(b) $f(x) = -4\sin(2x - 2\pi)$

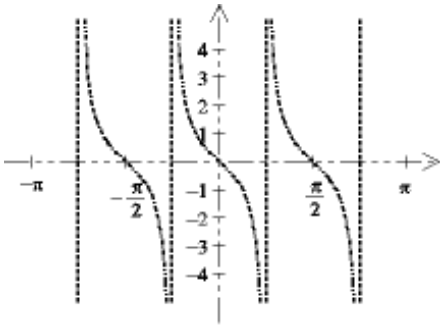
(c) $f(x) = 4\cos\left(\frac{x}{2} + \frac{\pi}{2}\right)$

(d) $f(x) = 4\cos(2x + 2\pi)$

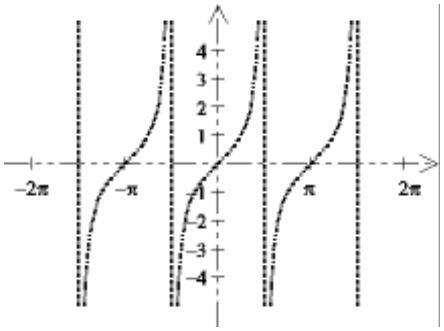
(e) none of the above

13. Which of the following is the graph of $f(x) = \tan\left(\frac{x}{2}\right)$?

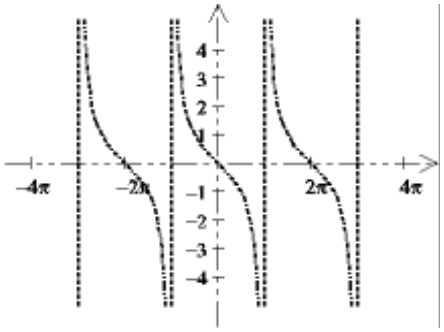
(a)



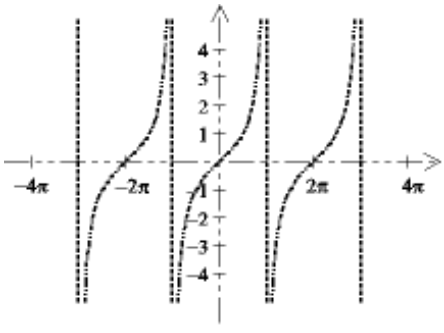
(b)

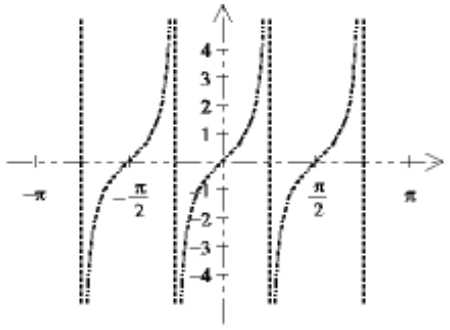


(c)



(d)



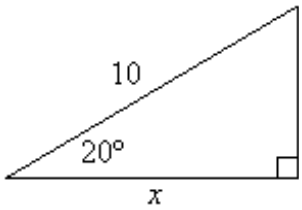
(e) 

14. If $\cos\theta = \frac{3}{5}$ and $\sin\theta = -\frac{4}{5}$, $0 \le \theta \le 2\pi$, then which of the following statements are true?

I. θ is in the second quadrant
II. $\tan\theta > 0$
III. θ is not an acute angle

(a) I only
(b) II and III only
(c) I, II, and III
(d) I and III only
(e) III only

15. Find x.



(a) $10\sin 20\,^\circ$
(b) $10\cos 20\,^\circ$
(c) $10\tan 20\,^\circ$
(d) $10\cot 20\,^\circ$
(e) none of the above