

Precalculus Chapter 3 Quiz

Submit your answers by midnight, Wednesday, March 18.

Multiple Choice

Identify the choice that best completes the statement or answers the question.

_____ 1. Determine the end behavior of $P(x) = -\frac{1}{9}x^3 + \frac{1}{3}x^2 + 12x$.

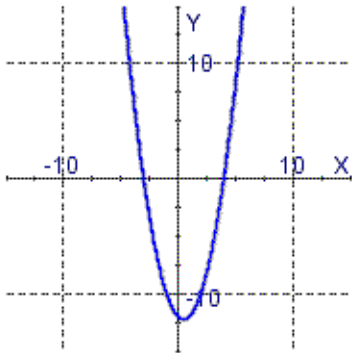
- a. $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
- b. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
- c. $y \rightarrow 0$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
- d. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow 0$ as $x \rightarrow -\infty$
- e. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$

_____ 2. Determine the end behavior of $P(x) = -x^4 + 5x^2 - 5x - 5$.

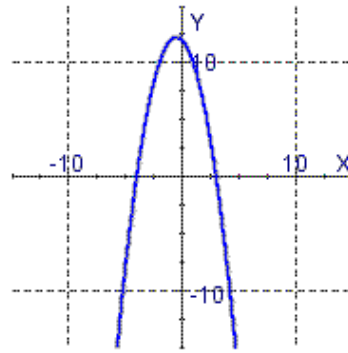
- a. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
- b. $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow 0$ as $x \rightarrow -\infty$
- c. $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
- d. $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
- e. $y \rightarrow 0$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$

3. Sketch the graph of the function $P(x) = (x - 3)(x + 4)$.

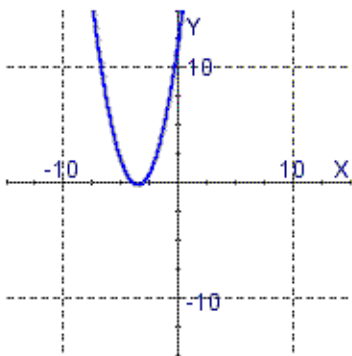
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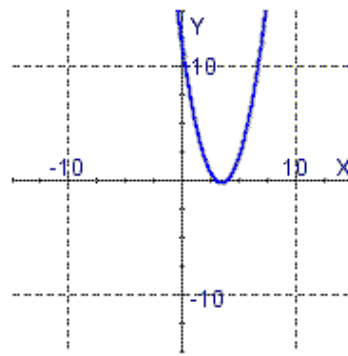
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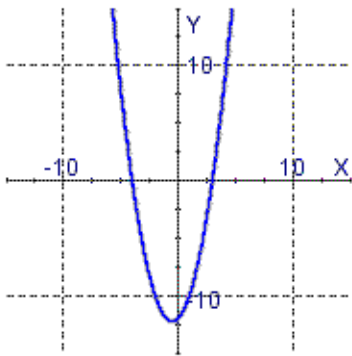
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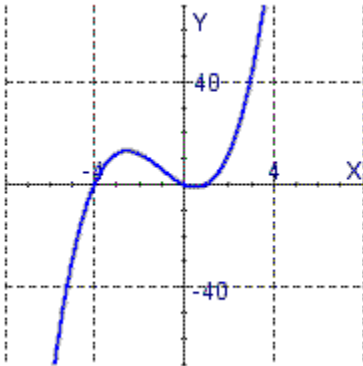


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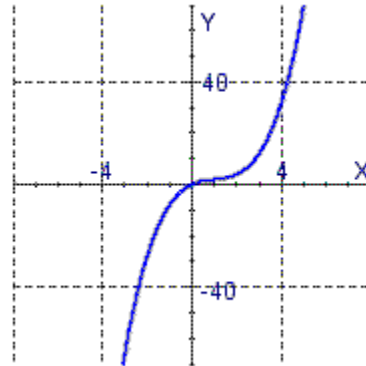


4. Sketch the graph of the function $P(x) = -x^3 - 3x^2 + 4x$.

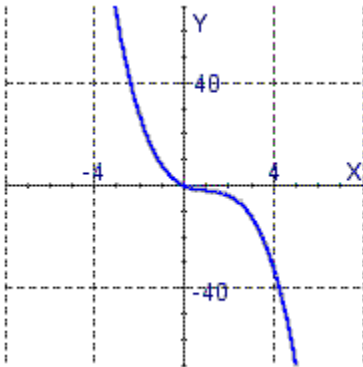
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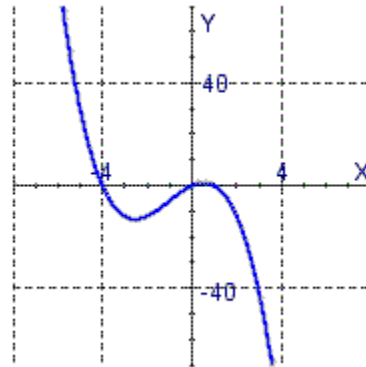
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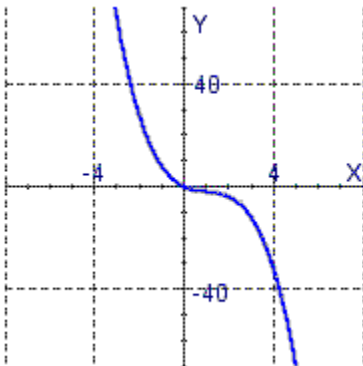
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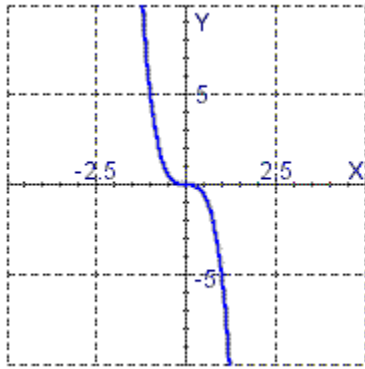


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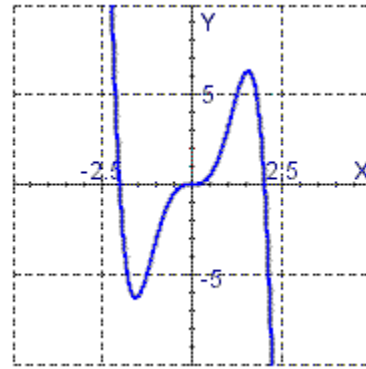


5. Sketch the graph of the function $P(x) = x^5 - 4.1x^3$.

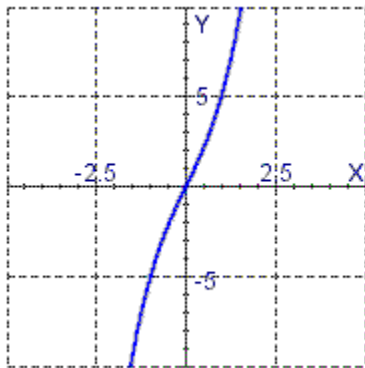
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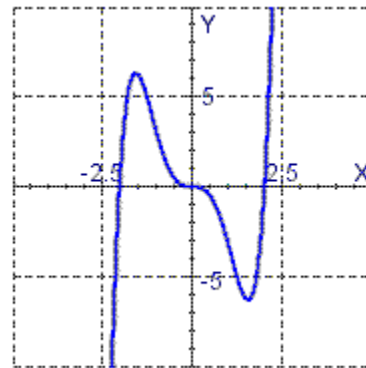
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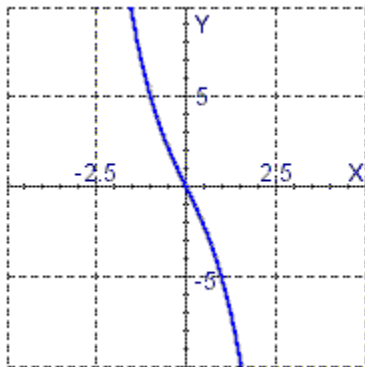
b.



e.



c.



_____ 6. Determine the end behavior of the graph of the function $y = 8x^3 - 7x^2 + 3x + 7$.

a. $y \rightarrow \infty$ as $x \rightarrow -\infty$, and $y \rightarrow -\infty$ as $x \rightarrow \infty$

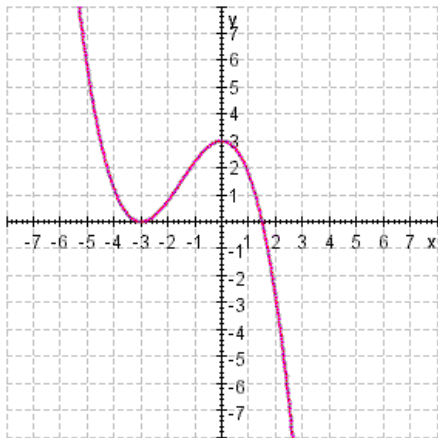
b. $y \rightarrow -\infty$ as $x \rightarrow \infty$, and $y \rightarrow \infty$ as $x \rightarrow \infty$

c. $y \rightarrow -\infty$ as $x \rightarrow -\infty$, and $y \rightarrow \infty$ as $x \rightarrow \infty$

d. $y \rightarrow \infty$ as $x \rightarrow -\infty$, and $y \rightarrow \infty$ as $x \rightarrow \infty$

e. $y \rightarrow -\infty$ as $x \rightarrow -\infty$, and $y \rightarrow \infty$ as $x \rightarrow -\infty$

_____ 7. The graph of a polynomial function is given.



From this graph, find the coordinates of all local extrema:

a. (1, 1)

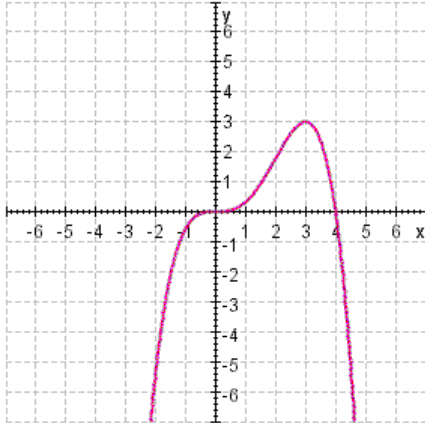
b. (-2, 0), (1, 3)

c. (-2, 0), (0, 3)

d. (-3, 0), (1, 3)

e. (-3, 0), (0, 3)

8. The graph of a polynomial function is given.



From this graph, find the coordinates of all local extrema:

- a. (0, 0)
- b. (3, 3)
- c. (3, -3)
- d. (0, 0), (3, 3)
- e. (2, 3)

9. Find the coordinates of the local extrema of the function $y = x^2 - 10x$.

- a. $x = -5, y = -25$
- b. $x = 10, y = -25$
- c. $x = 10, y = 25$
- d. $x = -10, y = -10$
- e. $x = 5, y = -25$

10. How many local maxima and minima does the polynomial $y = x^4 - 4x^2 + 4$ have?

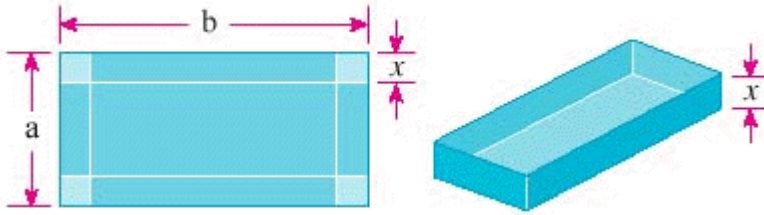
- a. 1 maximum and 0 minima
- b. 0 maxima and 2 minima
- c. 1 maximum and 2 minima
- d. 2 maxima and 1 minimum
- e. 1 maximum and 1 minimum

11. Find the x -coordinates of all the intersection points on a graph of the two functions, $y = x^3 - 5x^2 - 2x + 8$ and $y = -x^2 + 3x + 8$.

- a. 5, -1
- b. 0, -5, 1
- c. -5, 1
- d. 0, 5, -1
- e. 8, -5, 1

- ___ 12. What is the largest product A and B can have, given that $2A + 5B = 100$?
- 200
 - 250
 - 300
 - 350
 - 400

- ___ 13. An open rectangular box is to be constructed from a piece of cardboard $a = 14$ cm by $b = 43$ cm, by cutting squares of length x from each corner and folding up the sides, as shown in the figure.



What is the maximum volume to the nearest centimeter of such a box?

- 1635 cm^3
 - 1889 cm^3
 - 890 cm^3
 - 635 cm^3
 - 110 cm^3
- ___ 14. Divide $P(x)$ by $D(x)$ and express $P(x)$ in the form $P(x) = D(x) \cdot Q(x) + R(x)$, with:

$$P(x) = x^3 + 3x^2 - 5x + 1, D(x) = x - 1$$

- $P(x) = (x - 1) \cdot (2x^2 - 4x - 2) - 1$
- $P(x) = (x + 3) \cdot (2x^2 + 4x - 1) + 3$
- $P(x) = (x + 3) \cdot (x^2 + 6x + 2) + 3$
- $P(x) = (x - 1) \cdot (x^2 + 4x - 1) + 0$
- $P(x) = (x - 2) \cdot (2x^2 + 3x - 2) - 1$

_____ 15. Find the quotient and remainder using long division: $\frac{x^2 + 3x - 36}{x + 2}$

- a. no solution given
- b. The quotient is $x + 1$; the remainder is 1.
- c. The quotient is $x + 1$; the remainder is 3.
- d. The quotient is $x + 1$; the remainder is -41 .
- e. The quotient is $x + 1$; the remainder is -38 .

_____ 16. Find the quotient and remainder using long division: $\frac{12x^3 + 15x^2 + 21x}{3x^2 + 4}$

- a. no solution given
- b. The quotient is $5x - 20$; the remainder is $4x + 5$.
- c. The quotient is $4x + 5$; the remainder is $5x - 20$.
- d. The quotient is $4x - 5$; the remainder is $5x - 4$.
- e. The quotient is $5x - 20$; the remainder is $4x - 5$.

_____ 17. Find the quotient and remainder using long division: $\frac{x^6 + 8x^4 + 15x^2 + 8}{x^2 + 1}$

- a. The quotient is $x^4 + 7x^2 + 8$; the remainder is 0.
- b. The quotient is $x^2 - 7x - 8$; the remainder is 0.
- c. The quotient is $x^4 - 7x^2 - 8$; the remainder is 0.
- d. The quotient is $x^4 + 7x^2 - 8$; the remainder is 0.
- e. The quotient is $x^4 - 7x^2 + 8$; the remainder is 0.

_____ 18. Find the quotient and remainder using synthetic division: $\frac{x^3 + 12x^2 + 34x + 68}{x + 9}$

- a. The quotient is 5; the remainder is $x^2 + 3x + 7$.
- b. The quotient is $x^2 + 3x - 7$; the remainder is 5.
- c. The quotient is $x^2 - 3x - 7$; the remainder is 5.
- d. The quotient is 5; the remainder is $x^2 - 3x + 7$.
- e. The quotient is $x^2 + 3x + 7$; the remainder is 5.

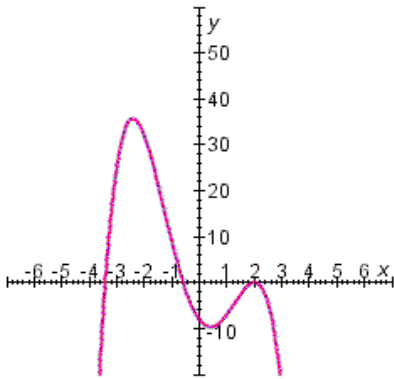
_____ 19. Find the quotient and remainder using synthetic division: $\frac{x^4 - 4x^3 + 22x^2 - 429x - 19}{x - 8}$

- a. The quotient is $x^3 + 4x^2 + 54x + 3$; the remainder is 5.
- b. The quotient is $x^3 - 4x^2 - 54x - 3$; the remainder is -5 .
- c. The quotient is $x^3 + 4x^2 + 54x + 3$; the remainder is -5 .
- d. The quotient is $x^3 + 4x^2 + 54x - 3$; the remainder is 5.
- e. The quotient is $x^3 + 4x^2 - 54x + 3$; the remainder is 5.

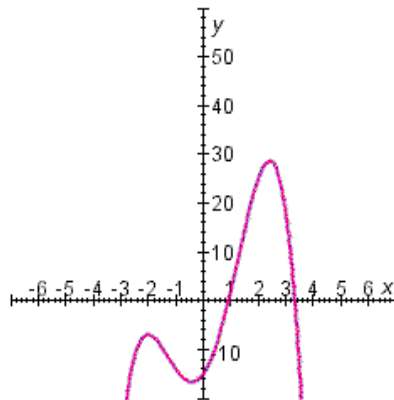
- _____ 20. Find the quotient and remainder using synthetic division: $\frac{3x^4 + 11x^3 + 15x^2 + 12x + 5}{x + \frac{2}{3}}$
- The quotient is $3x^3 - 9x^2 + 9x + 6$; the remainder is 1.
 - The quotient is $3x^3 + 9x^2 + 9x - 6$; the remainder is -1.
 - The quotient is $3x^3 - 9x^2 - 9x + 6$; the remainder is -1.
 - The quotient is $3x^3 + 9x^2 + 9x + 6$; the remainder is 1.
 - The quotient is $3x^3 - 9x^2 - 9x - 6$; the remainder is -1.
- _____ 21. Find a polynomial of degree 3 that has zeros of 2, -4, and 4, and where the coefficient of x^2 is 6.
- $-3x^3 + 6x^2 - 48x - 96$
 - $-3x^3 + 6x^2 + 48x - 96$
 - $-3x^3 + 6x^2 + 48x + 96$
 - $3x^3 - 6x^2 - 48x - 96$
 - $3x^3 + 6x^2 + 48x - 96$
- _____ 22. List all possible rational zeros given by the Rational Zeros Theorem (but don't check to see which actually are zeros): $U(x) = 6x^5 + 6x^3 - 2x + 12$
- $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$
 - $-1, -2, -3, -4, -6, -12$
 - $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{4}{3}, \pm \frac{1}{6}$
 - $1, 2, 3, 4, 6, 12, \frac{1}{2}, \frac{3}{2}, \frac{1}{3}, \frac{2}{3}, \frac{4}{3}, \frac{1}{6}$
 - $-1, -2, -3, -4, -6, -12, -\frac{1}{2}, -\frac{3}{2}, -\frac{1}{3}, -\frac{2}{3}, -\frac{4}{3}, -\frac{1}{6}$
- _____ 23. Use Descartes' Rule of Signs to determine how many positive and how many negative real zeros the polynomial can have. Then determine the possible total number of real zeros: $P(x) = 3x^3 - x^2 + 2x - 8$
- 1 positive, 1 negative
 - 1 negative
 - 3 negative
 - 0 or 2 positive
 - 1 or 3 positive

____ 24. Find all the real zeros of $P(x) = -x^4 + 10x^2 + 8x - 8$. Sketch the graph of P .

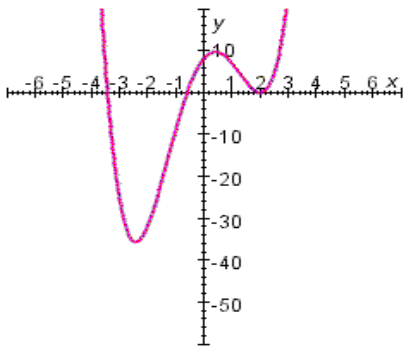
a.



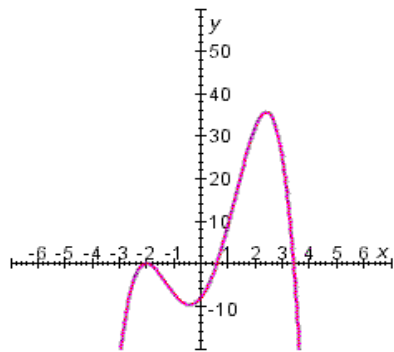
d.



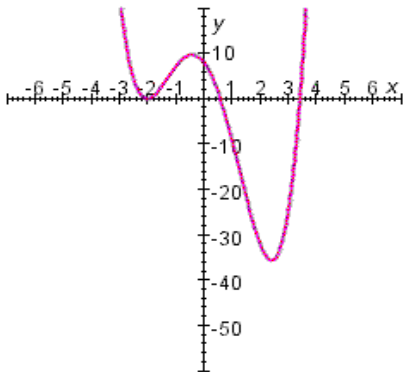
b.



e.



c.



____ 25. Find all rational zeros of the polynomial $P(x) = x^3 - 27x - 54$.

- a. $x = -3, x = -6$
- b. $x = -3, x = 6$
- c. $x = -6, x = 6$
- d. $x = 3, x = -3$
- e. $x = 3, x = 6$

____ 26. Find all rational zeros of the polynomial $P(x) = x^3 + 4x^2 + 10x + 12$.

- a. $x = 3$
- b. $x = -3$
- c. $x = -2$
- d. $x = 8$
- e. $x = 2$

____ 27. Find all rational zeros of the polynomial $P(x) = x^4 - 29x^2 + 100$.

- a. $x = -5, x = 5, x = 2$
- b. $x = -4, x = 4, x = -2, x = 2$
- c. $x = 5, x = -2, x = 2$
- d. $x = -21, x = 21, x = -2, x = 2$
- e. $x = -5, x = 5, x = -2, x = 2$

____ 28. Find all rational zeros of the polynomial $P(x) = x^4 + 11x^3 + 29x^2 - 11x - 30$.

- a. $x = -1, x = 1, x = 5, x = -6$
- b. $x = 1, x = 3, x = -5, x = -6$
- c. $x = -1, x = -5, x = -6$
- d. $x = -1, x = 1, x = -5, x = -6$
- e. $x = -1, x = 1, x = -5, x = 6$

____ 29. Find all rational zeros of the polynomial $P(x) = 2x^4 - 11x^3 + 11x^2 + 15x - 9$.

- a. $x = -3, x = -1, x = \frac{1}{2}$
- b. $x = 3, x = -1, x = \frac{1}{2}$
- c. $x = 5, x = -1, x = \frac{1}{2}$
- d. $x = 3, x = 1, x = \frac{1}{2}$
- e. $x = -3, x = 1, x = \frac{1}{2}$

____ 30. Find all the real zeros of the polynomial $P(x) = x^3 + 6x^2 + 7x - 4$.

- a. $x = -4, x = 4 \pm \sqrt{2}$
- b. $x = -1, x = -1 \pm \sqrt{2}$
- c. $x = -4, x = -1 \pm \sqrt{2}$
- d. $x = -1, x = -4 \pm \sqrt{2}$
- e. $x = 4, x = -4 \pm \sqrt{2}$

_____ 31. Find all the real zeros of the polynomial $P(x) = 24x^3 - 76x^2 + 2$.

a. $x = -\frac{1}{6}, x = \frac{3 \pm \sqrt{11}}{2}$

b. $x = -6, x = \frac{3 \pm \sqrt{11}}{2}$

c. $x = \frac{1}{6}, x = \frac{3 \pm \sqrt{11}}{2}$

d. $x = 6, x = \frac{3 \pm \sqrt{11}}{2}$

e. $x = \frac{1}{6}, x = \frac{3 \pm \sqrt{11}}{2}$

_____ 32. Find all the real zeros of the polynomial $P(x) = 5x^4 + 36x^3 + 47x^2 - 52x - 12$.

a. $x = -3, x = -\frac{1}{5}, x = 2 \pm 2\sqrt{2}$

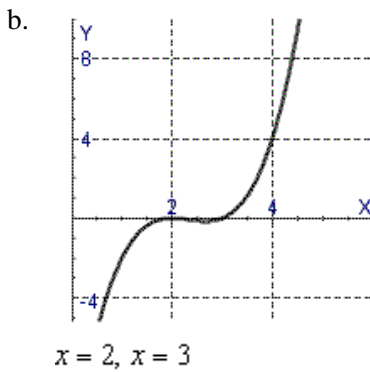
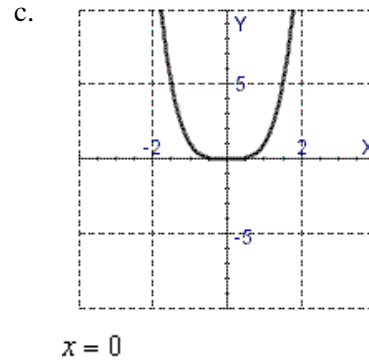
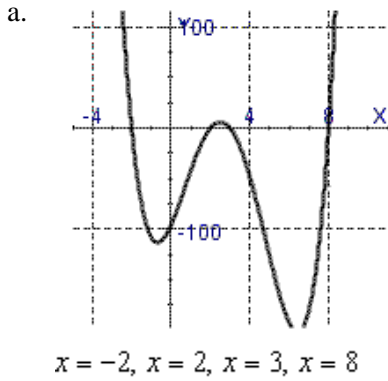
b. $x = 3, x = -\frac{1}{5}, x = -2 \pm 2\sqrt{2}$

c. $x = -3, x = -\frac{1}{5}, x = -2 \pm 2\sqrt{2}$

d. $x = 3, x = \frac{1}{5}, x = -2 - 2\sqrt{2}$

e. $x = -3, x = \frac{1}{5}, x = -2 \pm 2\sqrt{2}$

___ 33. Find all of the real zeros of the polynomial and sketch its graph: $P(x) = x^4 - 11x^3 + 20x^2 + 44x - 96$.



___ 34. Find integers that are upper and lower bounds for the real zeros of $P(x) = x^3 - 18x^2 + 67x + 30$.

- a. $x = -18, x = -1$
- b. $x = 1, x = 18$
- c. $x = -1, x = 18$
- d. $x = -1, x = -18$
- e. $x = 0, x = 1$

___ 35. Find the real and imaginary parts of the complex number $8 + 2i$.

- a. Real part 8, imaginary part 2
- b. Real part 2, imaginary part 8
- c. Real part 10, imaginary part i

___ 36. Evaluate the expression $(4 + 9i)(11 - 10i)$ and write the result in the form $a + bi$.

- a. $44 + 99i$
- b. $-59 - 134i$
- c. $59 + 134i$
- d. $134 + 59i$

- ___ 37. Evaluate the expression $\frac{145}{9-8i}$ and write the result in the form $a + bi$.
- $8 + 9i$
 - $9 + 8i$
 - $9 - 8i$
 - $-8 - 9i$
- ___ 38. Evaluate the expression i^{17} and write the result in the form $a + bi$.
- 1
 - 1
 - $-(i)$
 - i
- ___ 39. Evaluate the expression i^{64} and write the result in the form $a + bi$.
- $-i$
 - i
 - $-(1)$
 - 1
- ___ 40. Evaluate the expression $\sqrt{-4} \sqrt{-81}$ and write the result in the form $a + bi$.
- 18
 - $-18i$
 - 18
 - $18i$
- ___ 41. Evaluate the expression $(4 + \sqrt{-16})(8 - \sqrt{-25})$ and write the result in the form $a + bi$.
- $52 + 12i$
 - $12 - 52i$
 - $-20 + 12i$
 - $32 + 32i$
- ___ 42. Find all solutions of the equation $x^2 - 8x + 25 = 0$ and express them in the form $a + bi$.
- $x = 4, x = -4$
 - $x = 4 + 3i, x = 4 - 3i$
 - $x = 3 + 5i, x = 3 - 5i$
 - No solutions
- ___ 43. Find all solutions of the equation $z + 8 + \frac{20}{z} = 0$ and express them in the form $a + bi$.
- $z = 2 + 5i, z = 2 - 5i$
 - No solutions
 - $z = -4 + 2i, z = -4 - 2i$
 - $z = 4, z = -4$

___ 44. $P(x) = x^4 - 5x^2 - 6$. Factor P completely.

- a. $(x - \sqrt{5})(x + \sqrt{5})(x + i)(x - i)$
- b. $(x - \sqrt{6})(x + \sqrt{5})(x + i)(x - i)$
- c. $(x - \sqrt{3})(x + \sqrt{3})(x + i)(x - i)$
- d. $(x - \sqrt{6})(x + \sqrt{6})(x + i)(x - i)$
- e. $(x - \sqrt{5})(x + \sqrt{6})(x + i)(x - i)$

___ 45. Factor the $P(x) = x^4 + 14x^2 + 49$ completely and find all its zeros. State the multiplicity of each zero.

- a. $\sqrt{7}$ (multiplicity 1), $\sqrt{7}$ (multiplicity 1)
- b. $i\sqrt{7}$ (multiplicity 2), $i\sqrt{7}$ (multiplicity 1)
- c. 7 (multiplicity 2), -7 (multiplicity 2)
- d. $\sqrt{7}$ (multiplicity 1), $\sqrt{7}$ (multiplicity 1)
- e. $i\sqrt{7}$ (multiplicity 2), $-i\sqrt{7}$ (multiplicity 2)

___ 46. Factor the polynomial $P(x) = x^5 + 14x^3 + 49x$ completely and find all its zeros.

- a. $i\sqrt{7}, -i\sqrt{7}, 0$
- b. $\sqrt{7}, -\sqrt{7}i, 1$
- c. $\sqrt{7}, -\sqrt{7}, 1$
- d. 7 and -7
- e. 7, $-7, 0$

___ 47. Find the polynomial $P(x)$ of degree 4 with integer coefficients, and zeros $3 - 3i$ and 2 with 2, a zero of multiplicity 2.

- a. $x^4 - 3x^3 + 46x^2 - 2x + 3$
- b. $x^4 - 96x^3 + 46x^2 - 72x + 96$
- c. $x^4 - 10x^3 + 46x^2 - 77x + 14$
- d. $x^4 - 10x^3 - 46x^2 + 96x + 72$
- e. $x^4 - 10x^3 + 46x^2 - 96x + 72$

___ 48. Find the polynomial $P(x)$ of degree 4, and zeros $2 - i$ and $2i$, and constant coefficient 40.

- a. $x^4 - 8x^3 + 18x^2 - 40x + 32$
- b. $2x^4 - 8x^3 + 9x^2 - 26x + 24$
- c. $x^4 - 18x^3 + 8x^2 - 32x + 40$
- d. $2x^4 - 8x^3 + 18x^2 - 32x + 40$
- e. $2x^4 + 8x^3 - 18x^2 + 32x - 40$

____ 49. Factor the polynomial $P(x) = x^4 - 16x^2 - 225$ completely into linear factors with complex coefficients.

a. $(x + 3i)(x - 3i)(x + 5)(x - 5)$

b. $(x + 9i)(x - 9i)(x + 25)(x - 25)$

c. $(x^2 + 25)(x^3 - 9)$

d. $(x + 5i)(x - 5i)(x + 3)(x - 3)$

e. $(x^3 - 9)(x + 25)$

____ 50. Find the x - and y -intercepts of the rational function $r(x) = \frac{x - 6}{x + 6}$.

a. x -intercept $(6, 0)$, y -intercept $(0, -1)$

b. x -intercept $(6, 0)$, y -intercept $(0, -3)$

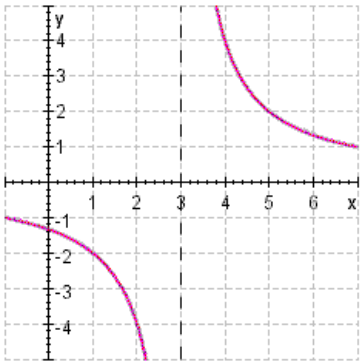
c. x -intercept $(1, 0)$, y -intercept $(0, 6)$

d. x -intercept $(-1, 0)$, y -intercept $(0, 6)$

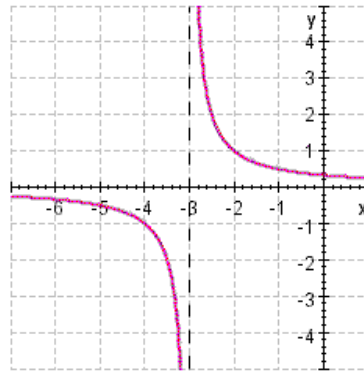
e. x -intercept $(-6, 0)$, y -intercept $(0, 0)$

51. Use transformations of the graph of $y = \frac{1}{x}$ to graph the rational function $r(x) = \frac{1}{x-3}$

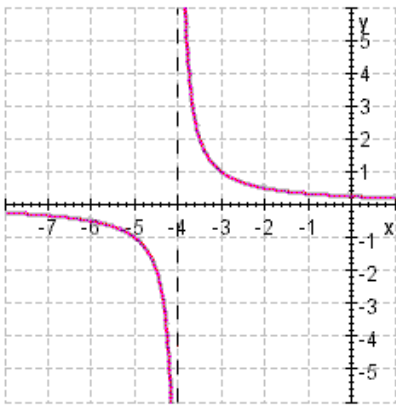
a.



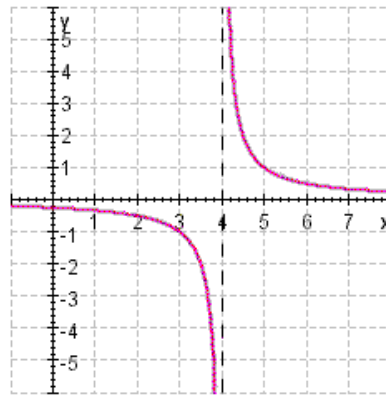
d.



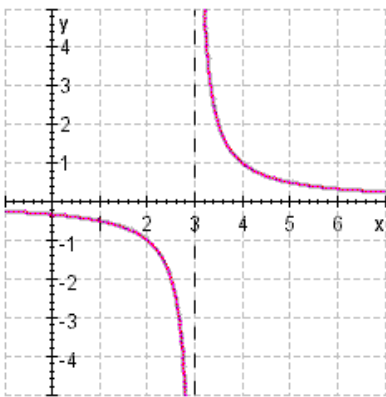
b.



e.

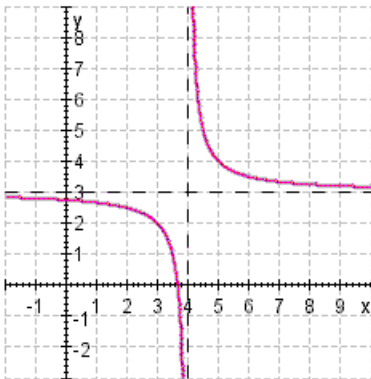


c.

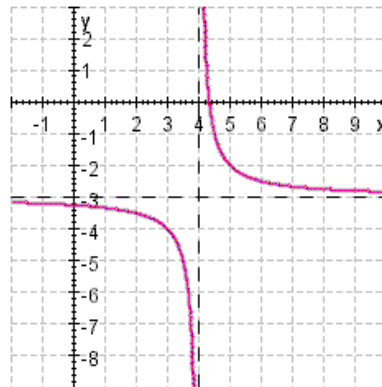


52. Use transformations of the graph of $y = \frac{1}{x}$ to graph the rational function $r(x) = \frac{3x - 11}{x - 4}$.

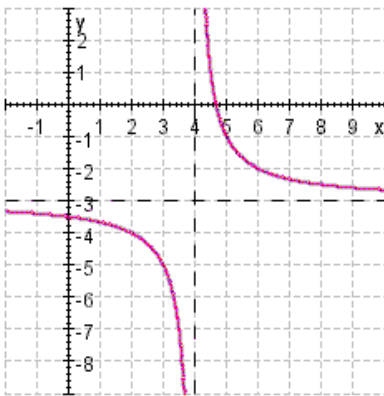
a.



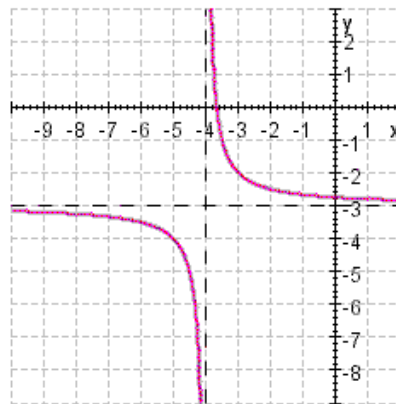
d.



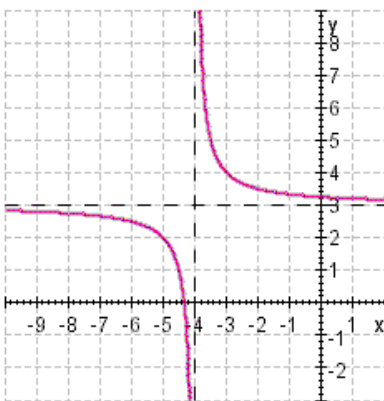
b.



e.



c.



____ 53. Find the intercepts and asymptotes of the rational function $r(x) = \frac{6x + 24}{-4x + 4}$.

a.

x-intercept	y-intercept	horizontal asymptote	vertical asymptote
(-4, 0)	(0, 6)	$y = 1$	$x = -1.5$

b.

x-intercept	y-intercept	horizontal asymptote	vertical asymptote
(-4, 0)	(0, 6)	$y = 2$	$x = -1.5$

c.

x-intercept	y-intercept	horizontal asymptote	vertical asymptote
(-4, 0)	(0, 6)	$y = 6$	$x = -6$

d.

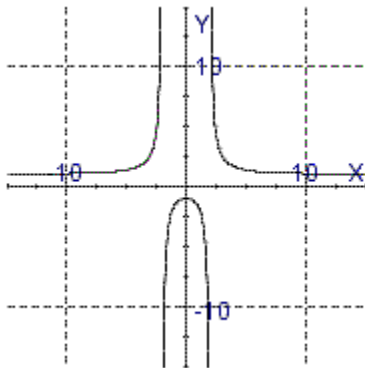
x-intercept	y-intercept	horizontal asymptote	vertical asymptote
(0, -4)	(6, 0)	$y = -1.5$	$x = 1$

e.

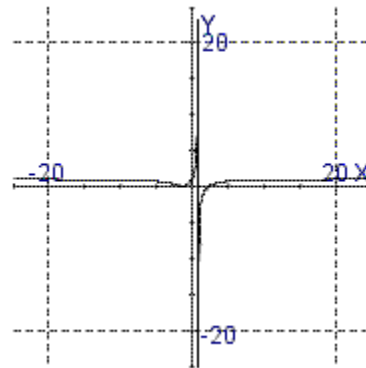
x-intercept	y-intercept	horizontal asymptote	vertical asymptote
(-4, 0)	(0, 6)	$y = -1.5$	$x = 1$

54. Determine the correct graph of the rational function $r(x) = \frac{x^2 - 4x + 4}{x^2 + 4x + 4}$.

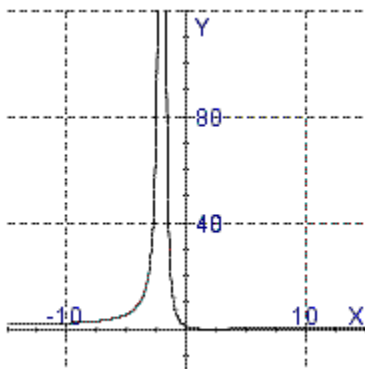
a.



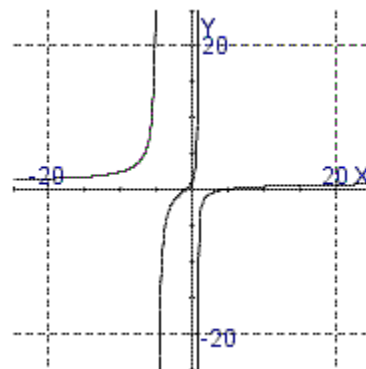
d.



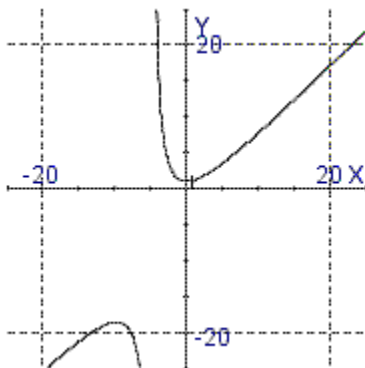
b.



e.



c.



55. Find the slant asymptote of the function $y = \frac{x^2}{x-4}$.

- a. $y = x + 8$
- b. $y = x + 4$
- c. $y = x + 7$
- d. $y = x - 5$
- e. $y = x - 6$

_____ 56. Given the function, $y = \frac{x^2 + 7x + 11}{x - 5}$, identify another function with the same end behavior.

- a. $y = x - 24$
- b. $y = x + 12$
- c. $y = x - 6$
- d. $y = x + 24$
- e. $y = x - 12$

_____ 57. Find a polynomial that has the same end behavior as the rational function $y = \frac{7x^5}{x^3 - 9}$.

- a. $y = 8x^2$
- b. $y = 7x^2$
- c. $y = 7x^2 - 1$
- d. $y = 6x^2$
- e. $y = 7x^2 - 9$

_____ 58. Find a polynomial that has the same end behavior as the rational function $y = \frac{x^4 - 9x^3 + 6}{x - 9}$.

- a. $y = x^2 - 9$
- b. $y = x^2 + 9$
- c. $y = x^3 + 9$
- d. $y = x^3$
- e. $y = x^3 - 9$

_____ 59. The rabbit population on Mr. Jenkins' farm follows the formula: $P(t) = \frac{5,000t}{t + 10}$.

For this formula, $t > 0$ is the time in months since the beginning of the year. What is the eventual population of rabbits?

- a. 4500 rabbits
- b. 5750 rabbits
- c. 5000 rabbits
- d. 5500 rabbits
- e. 6000 rabbits

_____ 60. After a certain drug is injected into a patient, the concentration C of the drug in the bloodstream is monitored. At time $t > 0$ (in minutes since the injection), the concentration (in mg/L) is given by the equation:

$$c(t) = \frac{20t}{t^2 + 2}$$

What is the eventual concentration of the drug?

- a. 0 mg/L
- b. 1 mg/L
- c. 2 mg/L
- d. 5 mg/L
- e. 2.5 mg/L

