Chapter R

1. Perform indicated operations. Express your answer as a single polynomial in standard form. Determine its degree and give the value of its leading coefficient

$$(4x-1)(4x+1)-2(2x^2-3x+1)$$

2. Find the quotient and the remainder when $3x^4-5x^3+2x-4$ is divided by x^2+3.
3. Factor completely each polynomial. If the polynomial cannot be factored, say it is prime.

a) $27-3x^2$

b) $2x^5+16x^2$

c) x^3+8x^2-20x

d) $2x^2+5x-3$

e) $2(3x+4)^2+(2x+3)\cdot 2(3x+4)\cdot 3$

4. Perform indicated operations and simplify the result. Leave your answer in factored form.

a) $\dfrac{x^2-3x-10}{x^2+2x-35}\cdot\dfrac{21-4x-x^2}{x^2+9x+14}$

b) $\dfrac{\dfrac{2x^2-x-28}{3x^2-x-2}}{\dfrac{x^2-3x-4}{x^2+2x-3}}$

c) $\dfrac{x+4}{x^2-x-2}-\dfrac{2x+3}{x^2+2x-8}$

d) $\dfrac{2+\dfrac{1}{x}}{4x-\dfrac{1}{x}}$

5. Simplify each expression. Express your answer so that only positive exponents occur. Assume that the variables are all positive.

a) $\dfrac{4x^{-2}(yz)^{-1}}{2^3x^4y}$

b) $(xy)^{\frac{1}{4}}(x^{-2}y^2)^{\frac{1}{2}}$

6. Write the expression as a single quotient in which only positive exponents and/or radicals appear. Assume x > -1.

$$\frac{\sqrt{1+x}-x\cdot\dfrac{1}{2\sqrt{1+x}}}{1+x}$$

7. Factor the expression. Express your answer so that only positive exponents occur.

$3(x^2+4)^{4/3}+x\cdot 4(x^2+4)^{1/3}\cdot 2x$

8. Simplify each expression. Assume all variables are positive

a) $\sqrt{\dfrac{x^5y^6}{4z^3}}$

b) $\sqrt[3]{27x^4y^{12}}$

9. Rationalize the denominator of each expression

a) $\dfrac{3}{2\sqrt{5}}$

b) $\dfrac{2\sqrt{3}-4}{\sqrt{3}+1}$

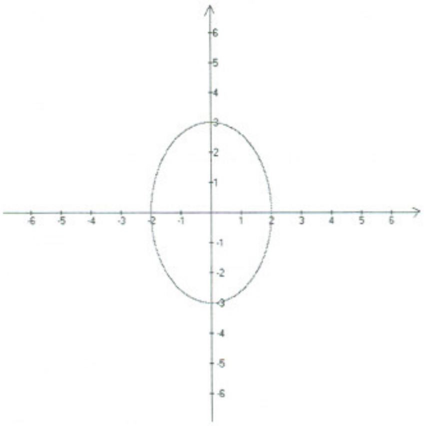
Chapter 2

10. Given two points A = (-1,0) and B = (2,4). Find

a) the exact distance between A and B

b) the midpoint of the line segment joining A and B

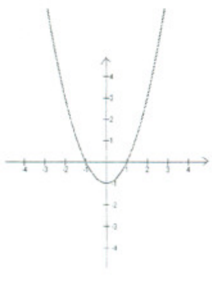
11. The graph of an equation is given below. List the x- and y-intercepts of the graph.



12. Find the intercepts of the graph of the equation $y^2 = x^2 + 5x + 4$

13. Based on the graph given below, determine whether it is symmetric with respect to the x-axis, the y-axis, and/or origin.

a)



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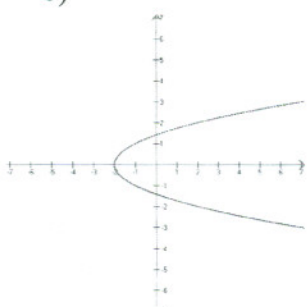

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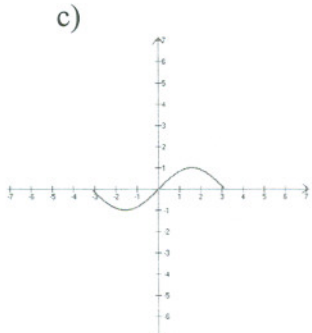

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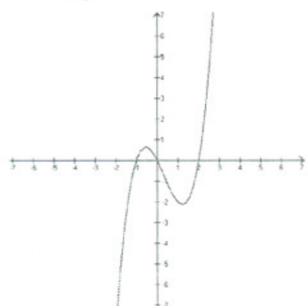


14. Test the equation for symmetry

a) $y = \dfrac{x^2-3}{2x^3}$

b) $y = 2x^2 - 3x + 1$

15. Write the standard form of the equation of the circle with center at C = (2,-3) and radius r = 4.

16. Find the center and the radius of a circle given by the equation $x^2 + y^2 - 6x + 8y - 2 = 0$

17. Find the slope of the line passing through the points (-2,3) and (-1, -4).

18. Graph the line containing the point P = (-1,2) and having the slope $m = -\dfrac{2}{3}$. Write the equation of this line in the slope-intercept form.

19. Find the slope and y-intercept of the line given by the equation -x + 3y = 6.

20. Find an equation of the line with the given properties. Express your answer in the slope intercept form

a) containing the points (-1, 0) and (2,4)

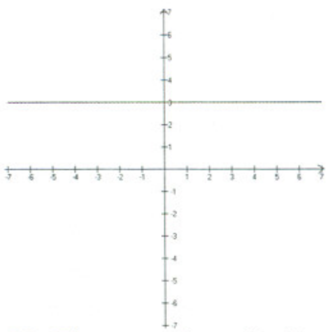
b) vertical; containing the point (6, -3)

c) horizontal; containing the point (-1, 5)

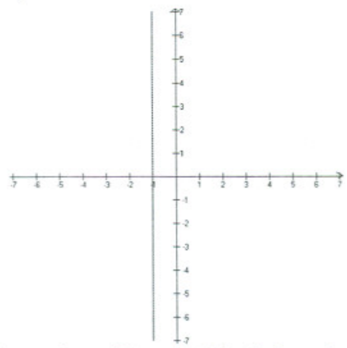
d) slope undefined; containing the point (2,4)

21. Find the equation of each line

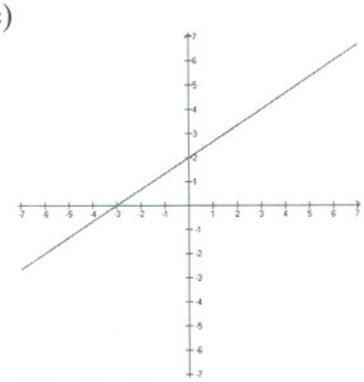
a)



b)



c)



22. The equation of a line L is 3x + 5y -10 = 0. Find the slope of a line that is

a) parallel to L

b) perpendicular to L

23. Find the equation for the line with given properties. Express your answer in the slope-intercept form.

a) parallel to the line 2x + y = 5; containing the point (2, - 1)

b) perpendicular to the line y = 2x + 4; containing the point (2, -1)

c) parallel to the line x = -2; containing the point (3, -1)

d) perpendicular to the line y = 3; containing the point (0,1).

24. Determine whether the lines 2x +3y = -3 and 3x + 2y = 10 are parallel, perpendicular or neither. Explain.

Chapter 3.

25. Determine whether the equation $x + y^2 = 1$ defines a function y = f(x).

26. For function $f(x) = \dfrac{2x+1}{3x-5}$, find the following values

a) f(0)

b) f(2)

c) f(-x)

d) -f(x)

e) f(x+1)

f) f(x+ h)

27. Find the domain of the following functions. Write it in the interval or set notation.

a) $f(x) = \dfrac{3x-6}{2x^2+9x+4}$

b) $f(x) = \sqrt{\dfrac{x-1}{x^2-16}}$

c) $f(x) = \dfrac{3x-6}{\sqrt{2x+1}-3}$

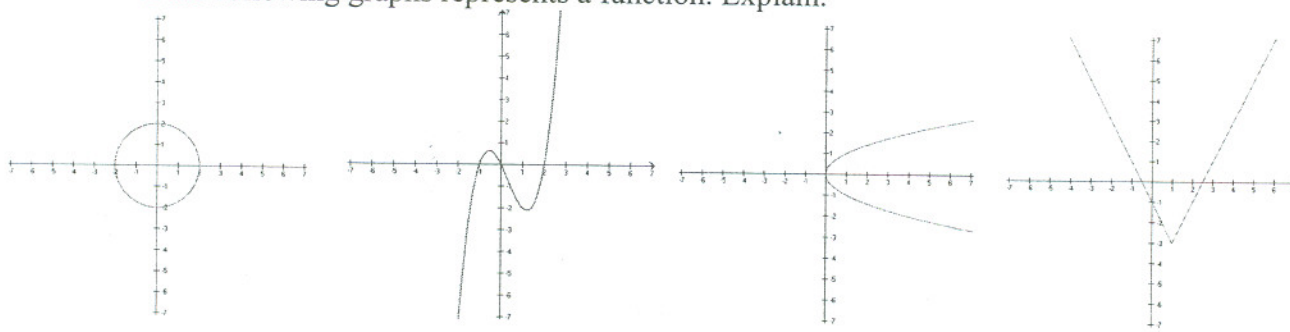
d) $f(x) = \dfrac{2x+1}{3|1-x|-12}$

28. Find and simplify the difference quotient $\dfrac{f(x+h)-f(x)}{h}, h \neq 0$ for $f(x) = 2x^2 - 3x + 5$.

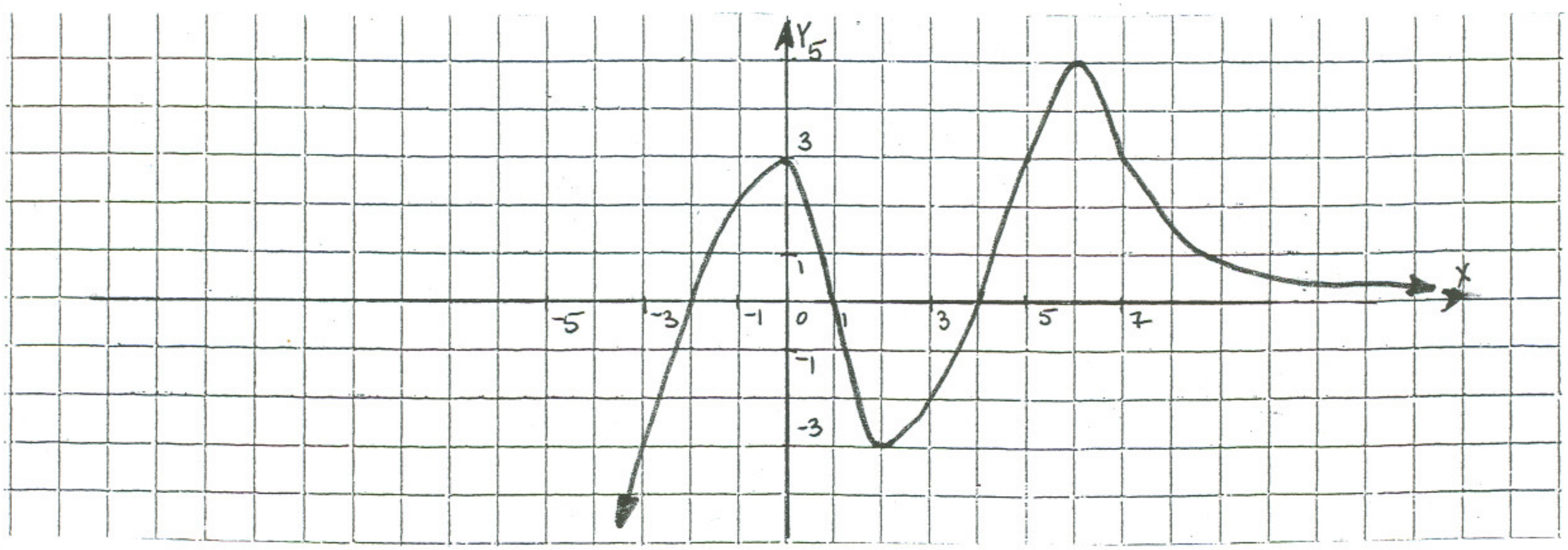
29. Given two functions $f(x) = \dfrac{2}{x}$ and $g(x) = \sqrt{x+1}$. Find the following functions and their domains

a) $f + g$
b) f - g
c) $f \cdot g$
d) $\dfrac{f}{g}$

30. Which of the following graphs represents a function. Explain.



31. Use the graph of the function f given below to answer parts a) - n)



a) Find f(0) and f(6).
b) Is f(2) positive or negative?
c) What is the domain of f?
d) What is the range of f?
e) What are the x-intercepts?
f) What is the y-intercept?
g) Find all values of x for which f(x) = 3.
h) List the interval(s) on which f is increasing.
i) List the interval(s) on which f is decreasing.
j) List the interval(s) on which f(x) >0

k) List the interval(s) on which $f(x) < 0$.

l) Find x, if any, at which f has a local maximum. What are these local maxima?

m) Find x, if any, at which f has a local minimum. What are these local minima?

n) Determine whether f is even, odd or neither.

32. Determine algebraically whether each function is even, odd or neither.

a) $f(x) = 2x^2 - 4x - 1$

b) $f(x) = \dfrac{3x}{x^2 + 4}$

c) $f(x) = \sqrt{x^2 + 1}$

33. Given

$$f(x) = \begin{cases} x^2 & ,x < 1 \\ 0 & ,x = 1 \\ 2x+1 & ,x > 1 \end{cases}$$

a) Graph the function f

b) Find the domain of f

c) Find the intercepts of f, if any.

d) Find the range of f

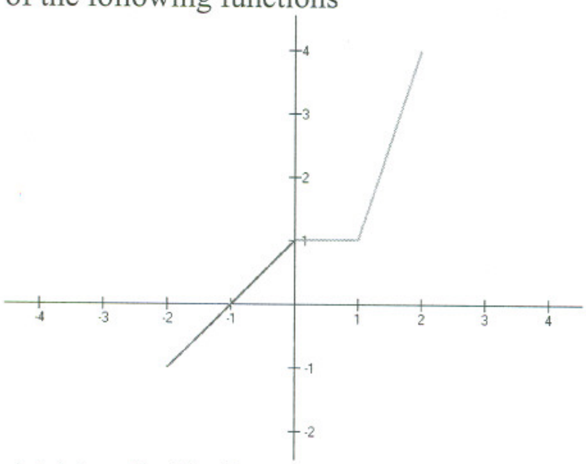
34. Graph each function using the techniques of shifting, compressing, stretching, and/or reflecting. Start with the graph of the basic function and show all stages

a) $f(x) = 2(x+1)^3 - 1$

b) $f(x) = -|x-3| + 2$

c) $f(x) = \sqrt{4x-8} + 2$

35. The graph of a function f is given below. Use the graph of f as the first step toward graphing each of the following functions



a) $h(x) = f(x-1) + 3$

b) $g(x) = f(-x)$

c) $p(x) = \dfrac{1}{2}f(x) - 2$

36. The price p and the quantity x sold of a certain product obey the demand equation

$$p = -\frac{1}{3}x + 100\ , \qquad 0 \le x \le 300$$

a) Express the revenue R as a function of x

b) What is the revenue if 100 units are sold?

37. An open box with the square base is to be made from a square piece of cardboard 24 inches on a side by cutting out a square from each corner and turning up the sides.
a) Express the volume V of the box as a function of the length x of the side of the square cut from each corner.
b) What is the volume if a 3-inch square is cut out?
c) What is the volume if a 10-inch square is cut out?
38. An open box with the square base is required to have a volume of 10 cubic feet.
a) Express the amount A of material used to make such a box as a function of the length x of the side of the square base.
b) How much material is required for a box with 1 foot by 1 foot square base?
39. Let P = (x,y) be a point of the graph of $y=\sqrt{x}$. Express the distance d from P to the point (1, 0) as a function of x. What is the domain of this function?

Chapter 4
40. Given f(x) = -3x + 1. Without computing or graphing, answer the nest two questions. What is the average rate of change of f? Is this function increasing, decreasing or constant?
41. Graph f(x) = $\frac{-2}{3}x-1$
42. Write the function $f(x)=2x^2-4x-1$ in the form $f(x)=a(x-h)^2+k$ and graph it using transformations.
43. Graph each quadratic function by determining whether its graph opens up or down and finding its vertex, axis of symmetry, y-intercept, and x-intercepts, if any.
a) $f(x)=2x^2-x-1$
b) $f(x)=-x^2+2x-4$
44. Determine, without graphing, whether the given quadratic function has the maximum value or the minimum value and then find this value.
a) $f(x)=2x^2-6x+1$
b) $f(x)=-x^2-3x+5$
45. A farmer with 4000 meters of fencing wants to enclose a rectangular plot that borders on a river. If the farmer does not fence the side along the river, what is the largest area that can be enclosed?
46. The price p and the quantity x sold of a certain product obey the demand equation

$$x=-5p+100\ , \qquad 0\le p\le 20$$

a) Express the revenue R as a function of x
b) What is the revenue if 15units are sold?
c) What quantity x maximizes revenue? What is the maximum revenue?
d) What price should the company charge to maximize revenue?

Chapter 5
47. Find the vertical and horizontal asymptotes, if any, of each rational function. Write their equations
a) $f(x)=\dfrac{2x^2+3}{x^2-3x-4}$
b) $f(x)=\dfrac{3x+1}{x^2-4}$
c) $f(x)=\dfrac{x^3+3}{2x-3}$

d) $f(x)=\dfrac{x^2-1}{x^2+x-2}$

48. Graph function $f(x)=\dfrac{x+1}{x^2-9}$. Find the domain, asymptotes, intercepts. Analyze the sign of f to determine where the graph is above the x-axes and where it is below x-axes.

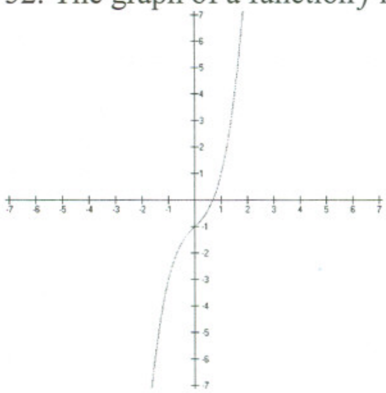
Chapter 6

49. Let $f(x)=|x-2|$ and $g(x)=\dfrac{2}{x+1}$. Find a) $(f\circ g)(4)$ b) $(g\circ f)(2)$ c) $(f\circ f)(1)$ d) $(g\circ g)(0)$

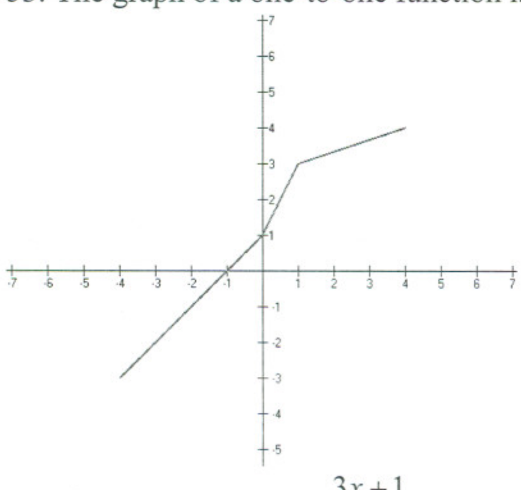
50. Let $f(x)=\dfrac{2x-3}{x+3}$ and $g(x)=-\dfrac{2}{x}$. Find $f\circ g$ and its domain. Make sure to simplify the formula for $f\circ g$.

51. Find functions f and g so that $f\circ g=H$, where $H(x)=\sqrt{x^2+3x-2}$.

52. The graph of a function f is given. Determine whether f is one-to-one. Explain.



53. The graph of a one-to-one function is given. Draw the graph of the inverse function f^{-1}.



54. The function $f(x)=\dfrac{3x+1}{2x-5}$ is one-to-one. Find its inverse f^{-1} and the domain and the range of f^{-1}.

55. Use transformations to graph a) $f(x)=1-3\cdot 2^{x+1}$, b) $f(x)=5-e^{-x}$. Determine its domain, range and horizontal asymptote.

56. Solve each equation

a) $5^{1-2x}=\dfrac{1}{5}$

b) $(e^4)^x e^{x^2}=e^{12}$

57. The number of people N in a college community who have heard a certain rumor is $N = P(1-e^{-0.15d})$, where P is the total population of the community and d is the number of days that have elapsed since the rumor began. In a community of 1000 students, how many students will have heard the rumor after 3days?

58. Change an exponential expression to an equivalent expression involving a logarithm

a) $2.2^N = 5$

b) $e^x = 8$

59. Change each logarithmic expression to an equivalent expression involving an exponent

a) $\log_b 4 = 2$

b) $\ln x = 4$

60. Find the exact value of each logarithm without using a calculator

a) $\log_{1/2} 4$ b) $\log_3 \frac{1}{27}$ c) $\ln e^3$ d) $\log_5 5^{4.2}$

61. Find the domain of $f(x) = \log_5 \frac{x+1}{x}$. Write it in the interval notation.

62.Use transformations to graph $f(x) = 2 + \ln(x-1)$. Determine its domain, range and vertical asymptote.

63. Solve the equations

a) $\log_2(2x+1) = 3$

b) $e^{2x+5} = \frac{1}{3}$

c) $\log_x 4 = 2$

64. The normal healing of wounds can be modeled by an exponential function. If A_0 represents the original area of the wound and if A equals the area of the wound after n days, then the formula $A = A_0 e^{-0.35n}$ describes the area of the wound on the *n*th day following an injuryu when no infection is present to retard the healing. Suppose that a wound initially had an area of 100 square millimeters.

a) If healing is taking place, how many days will pass before the wound is ½ of its original size?

b) How long before the wound is 10% of its original?

65. Use properties of logarithms to find the exact value of each expression

a) $\log_6 9 + \log_6 4$

b) $2^{\log_2 5}$

c) $\log_2 6 \cdot \log_6 4$

66. Use the change of the base formula and a calculator to find $\log_2 9$.

67. Write $\log_2 \frac{x^3\sqrt{x+1}}{(x-5)^2}$, x > 5 as a sum and/or difference of logarithms. Express powers as factors.

68. Write $3\log_5(3x+1) - 2\log_5(2x-1) - \log_5 x$ as a single logarithm.

69. Express y as a function of x, if $\ln y = -2x + \ln C$.

70. Solve the equations

a) $\log x + \log(x+15) = 2$

b) $2^{x+1} = 5^{1-2x}$

c) $\log_3 x + \log_3(x-2) = \log_3(x+4)$

d) $\ln(x+1) - \ln x = 2$

e) $5(2^{3x}) = 8$

f) $3^{2x} + 3^x - 2 = 0$

71. \$700 was invested at 6% compounded monthly. How much money will be in the account after 1.5 years?
72. How much money should be invested now at 8% compounded continuously to get \$1500 after 5 years?
73. How long does it take for an investment to double in value if it is invested at 8% per annum compounded monthly? Compounded continuously?
74. The half-life of radium is 1590 years. If 10grams is present now, how much will be present in 50 years?
75. A culture of bacteria obeys the law of uninhibited growth ($N(t) = N_0 e^{kt}$). If 500 bacteria are present initially and there are 800 after one hour, how many will be present in the culture after 5 hours? How long is it until there are 20,000 bacteria?

Chapter 12

76. Solve the following system of equations. If there are no solutions, say so. If there are infinitely many solutions, describe the solution set.

a) $\begin{cases} 5x - y = 13 \\ 2x + 3y = 12 \end{cases}$

b) $\begin{cases} 2x + y = 1 \\ 4x + 2y = 3 \end{cases}$

c) $\begin{cases} x + 2y = 4 \\ 2x = 8 - 4y \end{cases}$

d) $\begin{cases} 2x - y = -1 \\ 2x^2 + y^2 = 1 \end{cases}$

e) $\begin{cases} xy = 4 \\ 2x^2 - xy + y^2 = 8 \end{cases}$

77. Four large cheeseburgers and two chocolate shakes cost a total of \$7.90. Two shakes cost 15 ¢ more than one cheeseburger. What is the cost of cheeseburger? A shake?
78. Graph the inequality
a) $2x + y > 6$
b) $y > x^2 - 1$
79. Graph the system of inequalities

$$\begin{cases} 2x + y \le 4 \\ x + 5y \ge 5 \\ x \ge 0 \\ y \ge 0 \end{cases}$$