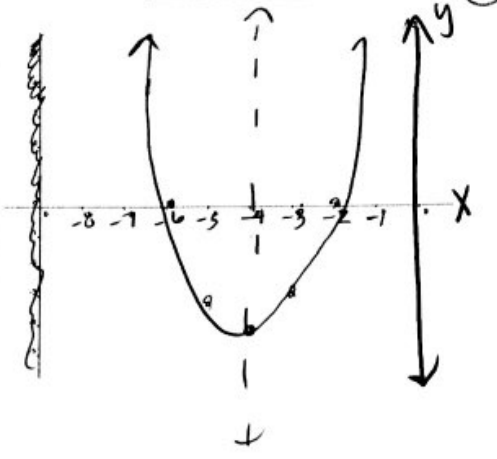
Identify the form of the quadratic equation and determine if the graph opens up or down. Then find the vertex, axis of symmetry, and x-intercepts and complete the table and graph the function.

41. $y = x^2 + 8x + 12$ Form: Standard (↑) or ↓

x	y
−6	0
−5	−3
−4	−4
−3	−3
−2	0



(−4, −4)

Vertex: $\frac{-b}{2a}$

$\frac{-8}{2} = -4$

$(-4)^2 + 8(-4) + 12 = -4$

A.O.S. $x = -4$

x-intercepts: $\{-6, -2\}$

$(x+6)(x+2) = 0$

42. ***Order the functions from narrowest graph to widest.***

A. $f(x) = -2x^2$ $g(x) = \frac{1}{3}x^2$ $h(x) = 4x^2$ h, f, g

B. $f(x) = -4x^2$ $g(x) = 6x^2$ $h(x) = .2x^2$ g, f, h

43. ***Compare the graph of each function with the graph of*** $f(x) = x^2$.

A. $g(x) = -\frac{1}{3}x^2 + 2$

reflection in x-axis, Vertical compression by 1/3, shift up 2

B. $g(x) = 2x^2 - 3$

Vertical stretch by 2, down 3

Find the equation of the axis of symmetry, y- intercept, and the coordinates of the vertex. Is the vertex a max or min?

44. $f(x) = (x-2)^2$ MIN

AOS: $x = 2$ Vertex (2, 0)

y-intercept: (0, 4)

45. $g(x) = (x+2)^2 + 4$ MIN

Vertex: (−2, 4) AOS $x = -2$

y-int: (0, 8)

46. $y = x^2 - 2x + 1$

$y = (x-1)^2$ MIN

AOS $x = 1$, Vertex (1, 0)

y-intercept (0, 1)

47. $y = 3x^2 + 6x + 1$

$\frac{-6}{2(3)} = -1$

AOS: $x = -1$

Vertex (−1, −2) MIN

y-int: (0, 1)

48. $y = -3x^2 + 6x + 4$

AOS: $\frac{-6}{2(-3)} = 1$ $x=1$

Vertex (1, 7) MAX

y-int. (0, 4)

49. $f(x) = -x^2 + 6x - 3$

y-int: (0, -3)

AOS: $\frac{-6}{2(-1)} = 3$ $x=3$

Vertex: (3, 6) MAX

50. $g(x) = -x^2 + 2$

AOS: $x=0$ Vertex MAX (0, 2)

y-intercept (0, 2)

51. $f(x) = 5x^2 - 4$

AOS: $x=0$ Vertex (0, -4) Min

y-int: (0, -4)

Match each equation to its graph.

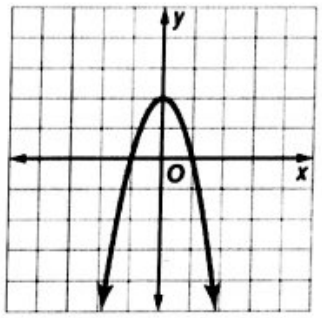
52. $y = 2x^2 - 2$ B

53. $y = \frac{1}{2}x^2 - 2$ D

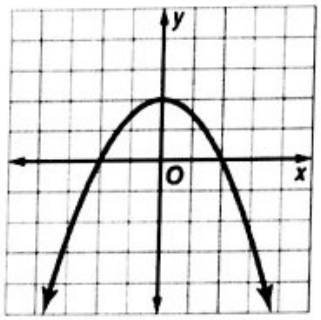
54. $y = -\frac{1}{2}x^2 + 2$ C

55. $y = -2x^2 + 2$ A

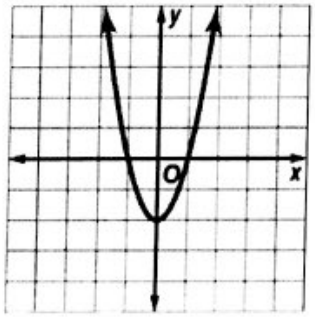
A.



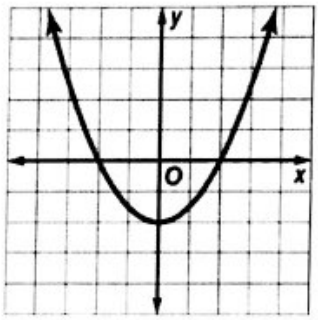
C.



B.



D.



56. A rocket is launched from atop a 101 foot cliff with an initial velocity of 116 ft/s.

a. Substitute the values into the vertical motion formula $h = -16t^2 + vt + c$. Let h(t) = 0

$0 = -16t^2 + 116t + 101$

b. Use the quadratic formula to find out how long the rocket will take to hit the ground after it is launched. Round to the nearest tenth of a second.

$$t = \frac{-116 \pm \sqrt{116^2 - 4(-16)(101)}}{-32} = \frac{-116 \pm \sqrt{19,920}}{-32}$$

$t = -0.786, 8.036$ second

57. The Freedom Tower in New York City is 1776 feet tall. The equation $f(t) = -16t^2 + 1776$ models the height $f(t)$ (in feet) of an object t seconds after it is dropped from the top of the tower.

a. After how many seconds will the object hit the ground? Round your answer to the nearest hundredth of a second.

$-16t^2+1776=0$
$-16t^2=-1776$
$t^2=111$
$t=\pm\sqrt{111}$
$t\approx 10.54$ sec

b. What is the height of the object 3 seconds after it has been dropped from the top of the tower?

$f(3)=-16(3)^2+1776=$ 1632 feet

58. The path of a soccer ball can be modeled by the equation $h = -16t^2 + 8t + 3$, where h is the height (in feet) of the soccer ball t seconds after the ball is kicked.

a. After how many seconds does the ball reach its maximum height?

$\frac{-8}{2(-16)}=\frac{-8}{-32}=$ 0.25 seconds

b. What is the maximum height of the soccer ball?

$h(0.25)=-16(0.25)^2+8(0.25)+3=$ 4 feet

59. Write the equation of the quadratic function with vertex $(3, -1)$ that passes through the point $(0, 2)$.

$f(x)=a(x-h)^2+k$
$2=a(0-3)^2-1$
$2=9a-1$
$9a=3$
$a=1/3$
$f(x)=\frac{1}{3}(x-3)^2-1$

60. A parabola has a vertex of $(-5,8)$ and passes through the point $(-7,-4)$. In the $y = a(x-h)^2 + k$ form of the parabola, what is the value of a?

$-4=a(-7+5)^2+8$
$-4=4a+8$
$a=-3$

61. A parabola has a vertex of $(-3,-21)$ and passes through the point $(-5,1)$. In the $y = a(x-h)^2 + k$ form of the parabola, what is the value of a?

$1=a(-5+3)^2-21$
$1=4a-21$
$4a=22$
$a=11/2$

Simplify completely.

62. $\sqrt{-28}=i\sqrt{28}$
$=i\sqrt{4\cdot 7}$
$2i\sqrt{7}$

63. $\sqrt{-32}=i\sqrt{32}=i\sqrt{16\cdot 2}$
$4i\sqrt{2}$

Perform the indicated operation.

64. $(6+3i)+(-4+10i)$

$2+13i$

65. $(-2+6i)-(2-3i)$

$-4+9i$

66. $3i(2+i)$

$6i + 3i^2$

$-3 + 6i$

67. $(2+i)(5-i)$

$10 - 2i + 5i - i^2$

$11 + 3i$

Divide the polynomials using long and synthetic division.

68. $(x^3 + x^2 + 2x + 24) \div (x+3)$

$x^2 - 2x + 8$

$x+3 \;|\; x^3 + x^2 + 2x + 24$

$-x^3 - 3x^2$

$-2x^2 + 2x$

$+2x^2 + 6x$

$8x + 24$

$-8x - 24$

0

$-3 \;|\; 1 \quad 1 \quad 2 \quad 24$

$\quad\quad -3 \quad 6 \quad -24$

$\quad\quad 1 \quad -2 \quad 8 \quad | \; 0$

$x^2 - 2x + 8$

69. $(4x^3 + 52x + 15) \div (x+5)$

$4x^2 - 20x + 152 - 745/(x+5)$

$x+5 \;|\; 4x^3 + 52x + 15$

$-4x^3 - 20x^2$

$-20x^2 + 52x$

$+20x^2 + 100x$

$152x + 15$

$-152x - 760$

-745

$-5 \;|\; 4 \quad 0 \quad 52 \quad 15$

$\quad\quad -20 \quad 100 \quad -760$

$\quad\quad 4 \quad -20 \quad 152 \quad | \; -745$

$4x^2 - 20x + 152 - 745/(x+5)$

Determine whether the binomial is a factor of the polynomial function.

70. $f(x) = 3x^3 + 7x^2 - 8x - 5;\ x + 5$

$-5 \;|\; 3 \quad 7 \quad -8 \quad -5$

$\quad\quad -15 \quad 40 \quad -160$

$\quad 3 \quad -8 \quad 32 \quad | \; -165$

No $\quad f(-5) \neq 0$

71. $f(x) = 2x^3 + 15x^2 - 23x + 36;\ x + 9$

$-9 \;|\; 2 \quad 15 \quad -23 \quad 36$

$\quad\quad -18 \quad 27 \quad -36$

$\quad 2 \quad -3 \quad 4 \quad | \; 0$

yes $\quad f(-9) = 0$

List all the possible rational zeros of the function. Then find all of the zeros.

72. $f(x) = x^3 + 9x^2 - 4x - 36$

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 9, \pm 12, \pm 18, \pm 36$

$2 \;|\; 1 \quad 9 \quad -4 \quad -36$

$\quad\quad 2 \quad 22 \quad 18$

$\quad 1 \quad 11 \quad 18 \quad | \; 0$

$x = 2, -2, -9$

$x^2 + 11x + 18 = 0$

$(x+9)(x+2) = 0$

73. $f(x) = 2x^3 + 11x^2 + 18x + 9$

$\pm 1, \pm 3, \pm 9, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}$

$-1 \;|\; 2 \quad 11 \quad 18 \quad 9$

$\quad\quad -2 \quad -9 \quad -9$

$\quad 2 \quad 9 \quad 9 \quad | \; 0$

$x = -1, -\frac{3}{2}, -3$

$2x^2 + 9x + 9 = 0$

$(2x+3)(x+3) = 0$