Answers

1) $3x^2\sqrt{2}$
2) $16\sqrt{2n}$
3) $-15v^2u\sqrt{6u}$
4) $24y\sqrt{7x}$
5) $3\sqrt{10}$
6) $-15\sqrt{10}$
7) $30\sqrt{3}$
8) -150
9) $-10x^2$
10) $20r^2\sqrt{2r}$
11) $-12b\sqrt{2}-4\sqrt{15b}$
12) $\sqrt{30k}+\sqrt{6k}$
13) $24n\sqrt{15}+30n\sqrt{3}$
14) $80\sqrt{2k}-4\sqrt{10k}$
15) $-10-25\sqrt{5x}+10\sqrt{5}+125\sqrt{x}$
16) $36\sqrt{x}+6\sqrt{15}-12\sqrt{15x}-30$
17) $\dfrac{\sqrt{2}}{2}$
18) $\dfrac{\sqrt{3}}{3}$
19) $\dfrac{2\sqrt{5}-5\sqrt{2}}{20}$
20) $2\sqrt{2}+\sqrt{6}$
21) $\dfrac{-20+5\sqrt{5}}{11}$
22) $15+10\sqrt{2}$
23) $\dfrac{5+5x^2\sqrt{3}}{3-9x^4}$
24) $\dfrac{-4+4\sqrt{3k}}{5k-15k^2}$
25) $2\sqrt{2}-2\sqrt{6}$
26) $-7\sqrt{6}$
27) $-8\sqrt{2}$
28) $10\sqrt{6}-\sqrt{5}+6\sqrt{3}$
29) $\sqrt{3}-3\sqrt{6}+2\sqrt{2}$
30) $-2\sqrt{5}-2\sqrt{2}$

31 The two binomials are $x-2$ and $3x-4$.

32 $(2x+5)(x-3)$

33 The factors are $x-5$ and $x+2$

34
a) $4xy^3(3y-16x^2+10xy^4)$
b) $4(x+10)(x-3)$
c) $(5b-6a^2)(5b+6a^2)$
d) $(y+6)(x-z)$

35
a) $(y-1)(y+1)$
b) $(x-3)(x+3)$
c) $(4-5x)(4+5x)$
d) $xyz(1-x)(1+x)$
e) $(y+a)(x-3)(x+3)$
f) $(a+b-4)(a+b+4)$
g) $(2x+2y)4x$

36

a) $2(9x + 10)$

b) $4(3x + y)$

c) $4x(5y + 4)$

d) $m^6(m^2 + 1)$

e) $2(3x^2 - x + 2)$

f) $a(a - b - 1)$

g) $7xy^2(x^4 + 3xy + 2y^2)$

h) $(m + n)(x + y)$

i) $(a + b)(c - 1)$

j) $2(3x - 2)(3x^2 + x - 2)$

37 D

38 C

39 D

40 B

41 B

42 D

43 B

44 C

45

a) $\{0, 1\}$

b) $\left\{-\frac{1}{3}, \frac{2}{5}\right\}$

c) $\left\{-\frac{4}{3}, 2\right\}$

d) $\left\{-\frac{3}{2}, 1\right\}$

46

a) $f(0) = 2$ b) $f(3) = -7$ c) $f(5) = 17$

47

When Charles threw the ball, his hand was **7.2** m from the wall.

48

C

49

D

50

C

51

D

52

B

53

B

54

C

55 B

56 B

57 C

58 Equation of the parabola

According to the table of values, the coordinates of the vertex of the parabola are S(29, 150).

$y = a(x - h)^2 + k$

$y = a(x - 29)^2 + 150$

$54 = a(9 - 29)^2 + 150$

$-96 = 400a$

$-0.24 = a$

The equation of the parabola is $y = -0.24(x - 29)^2 + 150$.

Launching point

If $y = 0$, then $0 = -0{,}24(x - 29)^2 + 150$ Hence, $x = 4$ and $x = 54$

Since the launching point is to the left of the vertex of the parabola, the coordinates of the launching point are $x = 4$ and $y = 0$.

Position of the rocket when it exploded

If $y = 96$, then $96 = -0.24(x - 29)^2 + 150$ Hence, $x = 14$ or $x = 44$

Since the position of the rocket when it exploded is the right of the vertex of the parabola, the coordinates of the position of the rocket when it exploded are $x = 44$ and $y = 96$.

Position of the fountain

Since the rocket exploded 96 m above the fountain, the coordinates of the position of the fountain are $x = 44$ and $y = 0$.

Distance between the launching point and the fountain

$44 - 4 = 40$ m

Answer The distance between the point from which the rocket was launched and the fountain is 40 m.

59

Rule of the function

x: time in minutes

$f(x)$ = altitude in metres

$f(x) = a(x - h)^2 + k$

$f(x) = a(x - 3)^2 + 10$

$f(8) = 0$ then $0 = a(8 - 3)^2 + 10$

$0 = a(25) + 10$

$$\frac{-10}{25} = a$$

$-0.4 = a$

$f(x) = -0.4(x - 3)^2 + 10$

***y*-intercept**

$f(0) = -0.4(0 - 3)^2 + 10 = 6.4$

Answer The balcony is located 6.4 m off the ground.

60

Coordinates of point B

The axis of symmetry of the parabola representing f is $x = 3$.

Since the coordinates of A are A(0, 0), the coordinates of B are B(6, 0).

Rule of g

Since the zeros of function g are 6 and 10, the equation of the axis of symmetry of the parabola representing g is $x = 8$.

The coordinates of the vertex are h = 8 and k = 4.

$g(x) = a(x - 8)^2 + 4$

$0 = a(6 - 8)^2 + 4$

$0 = 4a + 4$

$-4 = 4a$

$-1 = a$

$g(x) = -1(x - 8)^2 + 4$

Answer: The rule of the function g is $g(x) = -(x - 8)^2 + 4$.

61 ***x*-coordinate of the location of the basket**

y-coordinate of the location of the basket: 3

$$-0.2(x-5)^2 + 3.45 = 3$$

$$-0.2(x-5)^2 = -0.45$$

$$(x-5)^2 = 2.25$$

$$x - 5 = -1.5 \quad \text{or} \quad x - 5 = 1.5$$

$$x = 3.5 \qquad\qquad x = 6.5$$

Since the basket is located to the right of the vertex of the parabola, $x = 6.5$.

x-coordinate of the location of the basket: 6.5

***y*-coordinate of the location of the ball at the moment Caroline throws it**

x-coordinate of the location of the ball at the moment Caroline throws it: $6.5 - 4.5 = 2$

$$f(2) = -0.2(2-5)^2 + 3.45 = 1.65$$

y-coordinate of the location of the ball at the moment Caroline throws it: 1.65

Answer: At the moment that Caroline throws the ball, the distance between the ball and the ground is **1.65** m.

62 B

63 B

64 C

65 C

66 C

#67)

a) $x = 3$

$y = 4$

b) $x = 2$

$y = 3$

68 The missing equation is $3y = 2x$

or an equivalent equation such as $3y - 2x = 0$

69 750 agendas.

70 The coordinates of the points are P(-6, 5) and Q(5, 16).

71 The coordinates of point T are T**(22, 6)**.

72 Let x : represent the number of white balls

y : represent the number of green balls

x : represent the number of yellow balls

The system of equations

$2x + y = 120$

$y + 20 = 2x$

Solution of the system of equations

$$\begin{aligned} 2x + y &= 120 \\ 2x - y &= 20 \\ 4x &= 140 \\ x &= 35 \quad \text{and} \quad y = 50 \end{aligned}$$

Result : The number of white and yellow balls is 35 each and the number of green balls is 50.

73 Rule for calculating Annie's debt $D_1(x)$ as a function of the number of months elapsed x

$D_1(x) = 500 - 40x$

Rule for calculating Mark's debt $D_2(x)$ as a function of the number of months elapsed x

$D_2(x) = 600 - 60x$

Number of months elapsed when $D_1(x) = D_2(x)$

$$500 - 40x = 600 - 60x$$

$$20x = 100$$

$$x = 5$$

Result : After 5 months, Annie's debt will be equal to Mark's.

74 **Coordinates of point P**

If $x = 0$ then $y = 4(0)^2 - 40(0) + 101 = 101$

P(0, 101)

Coordinates of point S

The x-coordinate of the vertex of the parabola:

$$\frac{-b}{2a} = \frac{-(-40)}{2 \times 4} = 5$$

The y-coordinate of the vertex of the parabola:

S(5, 1)

Slope of the line passing through P and S

slope: $\frac{101 - 1}{0 - 5} = -20$

***y*-intercept of the line passing through P and S**

The y-intercept of the line is the same as that of the parabola (i.e. 101).

Answer The equation of the line passing through points P and S is $y = -20x + 101$.

75 Coordinates of point M

In the equation of a parabola in the general form, the x-coordinate of the vertex is $x = \frac{-b}{2a}$.

x-coordinate:

$$x = \frac{-12}{2(-2)} \\ = 3$$

y-coordinate

$$y = -2(3)^2 + 12(3) - 8 \\ = 10$$

Coordinates of point M: M(3, 10)

Equation of line MN

Slope

$$\frac{22-10}{0-3} = \frac{12}{-3} \\ = -4$$

y-intercept : 22

Equation of line MN

$y = -4x + 22$

Coordinates of point N

$$\left.\begin{array}{l} y = -2x^2 + 12x - 8 \\ y = -4x + 22 \end{array}\right\} \Rightarrow \begin{array}{l} -2x^2 + 12x - 8 = -4x + 22 \\ -2x^2 + 16x - 30 = 0 \\ -2(x^2 - 8x + 15) = 0 \\ (x-3)(x-5) = 0 \\ x = 3 \quad \text{or} \quad x = 5 \end{array}$$

If $x = 3$, then $y = -4(3) + 22 = 10$. This would be point M.

If $x = 5$, then $y = -4(5) + 22 = 2$. This would be point N.

Coordinates of point N: N(5, 2)

Answer: The coordinates of point N are N**(5, 2)**.

76 Let x = width of fenced-in plot in metres

$25 - 2x$ = length of fenced-in plot in metres

Area of plot = length × width = $x(25 - 2x)$

$x(25 - 2x) \geq 50$

$25x - 2x^2 \geq 50$

$-2x^2 + 25x - 50 \geq 0$

$2x^2 - 25x + 50 \leq 0$

$(2x - 5)(x - 10) \leq 0$

Zeros

$2x - 5 = 0$ or $x - 10 = 0$

$x = 2.5$ $x = 10$

Zeros are 2.5 and 10

Width of plot 2.5 m

Answer The smallest value of dimension x is 2.5 m.

77 B

78 Result : $x \in \,]2, 4[$

79 48 seconds must elapse for the projectile to reach a height greater than 800 meters.

80 D

81 A

82 It will cost \$13.25 to send the parcel.

83 D

84 B

85 C

86 A

87 B

88 C

89 D

90 Rule of Correspondence

$C(n) = 10 - 0.40\left[\frac{n}{100}\right]$

Number of kilograms of sugar ordered:

$4 = 10 - 0.40\left[\frac{n}{100}\right]$

$-6 = -0.40\left[\frac{n}{100}\right]$

$15 = \left[\frac{n}{100}\right]$

$15 \le \frac{n}{100} < 16$

$1500 \le n < 1600$

Answer: The possible quantities of sugar, in kilograms, are [1500, 1600[.

91

Greatest integer function

$$x = 0 \Rightarrow \quad y = 32.5[0.05(0) + 3] + 52.5$$
$$= 32.5[3] + 52.5$$
$$= 150 \text{ cm}$$

Step length $= \dfrac{1}{0.05} = 20 \Rightarrow$ Last open point is (20, 150)

Quadratic function

$$150 = a(20 - 200)^2 + 30$$
$$120 = 32400a \qquad \text{Equation} \quad y = \frac{1}{270}(x - 200)^2 + 30$$
$$\frac{1}{270} = a$$

$$x = 180 \Rightarrow \quad y = \frac{1}{270}(180 - 200)^2 + 30$$
$$y = 31.48$$

Answer: To the nearest tenth of a centimetre, the distance is **31.5** cm.