Solutions ⇝ Maximum Height & Maximum Area

1. $h(t) = -5t^2 + 50t$

↳ $y = -5t^2 + 50t$

To find the maximum height you need to "complete the square" and determine the "y" value of the vertex.

$y = -5(t^2 - 10t)$
$y - 125 = -5(t^2 - 10t + 25)$
$y - 125 = -5(t-5)^2$
$y = -5(t-5)^2 + 125$

Vertex $(5, 125)$
Time ↓ Maximum Height ↓

Therefore, the maximum height of the soccer ball is 125 m. (C)

2. $h = -7t^2 + 42t$

↳ $y = -7t^2 + 42t$

To find out how many seconds it takes to reach the maximum height, you need to "complete the square" and determine the "x" value of the vertex.

$y = -7(t^2 - 6t)$
$y - 63 = -7(t^2 - 6t + 9)$
$y - 63 = -7(t-3)^2$
$y = -7(t-3)^2 + 63$

Vertex $(3, 63)$
Time ↓ Maximum Height ↓

Therefore, it took the golf ball 3 seconds to reach the maximum height. (A)

3. $h(t) = -2t^2 + 20t$
↳ $y = -2t^2 + 20t$

When the rocket hits the ground, it has a height of zero $(y=0)$

↳ $0 = -2t^2 + 20t$
If we factor:

$0 = -2t(t - 10)$

Either $-2t = 0$ or $t - 10 = 0$

$\frac{-2t}{-2} = \frac{0}{-2}$ $\quad t - 10 = 0$
$t = 0$ $\quad t = 10$

Alternate Methods:

1) Substitute answers into equation and see which one "works".

2) Use Graphing Calculator to find the "zero" (2nd Trace, #2)

$t=0$ when the rocket is launched, therefore $t=10$ when it returns to the ground. (D)

4. $h = -3t^2 + 24t + 1$

To determine how high the rocket is after 2 seconds, substitute $(t=2)$ into the equation and solve.

$h = -3(2)^2 + 24(2) + 1$
$h = -3(4) + 48 + 1$
$h = -12 + 49$
$h = 37$

Therefore, the rocket is 37 m high after 2 seconds.

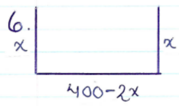
5. $h = -3t^2 + 24t + 5$

The ball is kicked from the balcony at time zero ($t=0$).

Therefore, by substituting $t=0$ into the equation we can determine the initial height of the ball (= the height of the balcony)

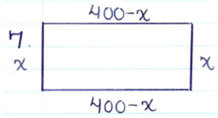
$h = -3(0)^2 + 24(0) + 5$
$h = 0 + 0 + 5$
$h = 5\,m$

Therefore, the balcony is 5 m off of the ground

6.


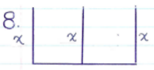
400m of fencing => Perimeter = 400
Let x = width
Then $400 - 2x$ = length.

Area = $l \times w$
$= (400-2x)(x)$ (C)

7.


800m of fencing => Perimeter = 800
Let x = width
Then $\frac{800-2x}{2}$ = length
$400 - x$ = length

Area = $l \times w$
$= (400-x)(x)$ (B)

8.


900 m of fencing => Perimeter = 900

Let x = width
Then $900 - 3x$ = length

Area = $l \times w$
$A = (900-3x)(x)$
or $y = (900-3x)(x)$

To determine the maximum area, you need to "complete the square."

$y = (900-3x)(x)$
$y = 900x - 3x^2$
or $y = -3x^2 + 900x$ (GF)
$y = -3(x^2 - 300x)$
$y - 67\,500 = -3(x^2 - 300x + 22\,500)$
$y - 67\,500 = -3(x-150)^2$
$y = -3(x-150)^2 + 67\,500$ (SF)

Vertex (150, 67 500)
↳ width ↳ maximum area

Therefore, the maximum area of the figure is 67 500 m².