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 $(5, 125)$

$\underset{\text{Time}}{5}$, $\underset{\text{Maximum Height}}{125}$

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 $(3, 63)$

$\downarrow$ Time $\downarrow$ 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 $t - 10 = 0$

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

$t = 0$

$t - 10 = 0$

$t = 10$

Alternate Methods:

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

2) Use Graphing Calculator to find the "zero" (2^{nd} 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. $h = -3t^2 + 24t + 5$

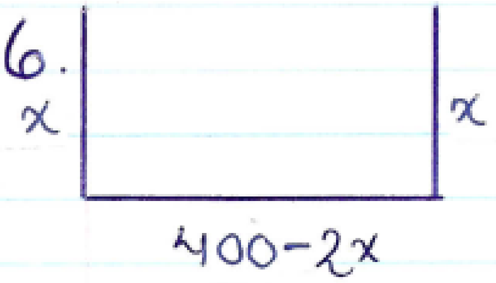
The ball is kicked from the balcony at time zero ($t=0$).

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

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

Therefore, the balcony is 5 m off of the ground

6.



400m of fencing $\Rightarrow$ Perimeter $= 400$

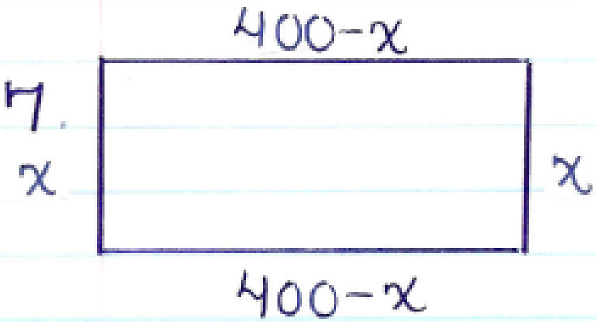
Let $x =$ width

Then $400-2x =$ length.

Area $= l \times w$

$= (400-2x)(x)$ (C)

7.



800m of fencing $\Rightarrow$ Perimeter $= 800$

Let $x =$ width

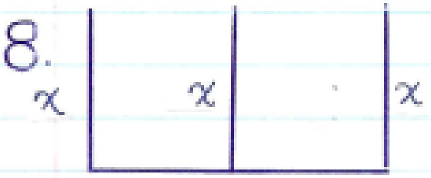
Then $\frac{800-2x}{2} =$ length

$400-x =$ 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."

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

Vertex (150, 67500)
↳ width ↳ maximum area

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