

PROBLEM SOLVING - SOLUTIONS

Q1.

$$(a) \quad h = -4t(t-30)$$

$$\begin{aligned} \text{When } t = 10, \quad h &= -4 \times 10 \times (10-30) \\ &= -40 \times -20 \\ &= 800 \end{aligned}$$

$$\therefore h = 800 \text{ m}$$

(b) Let $h = 0$

$$\begin{aligned} 0 &= -4t(t-30) \\ &\quad \downarrow \quad \downarrow \\ &\quad t=0 \quad t=30 \end{aligned}$$

$h = 0$ when $t = 0, 30$.

$$(c) \quad 30 - 0 = 30 \text{ seconds}$$

$$Q2. (\star) \quad y = -\frac{1}{25}(x-15)^2 + 9$$

When ball hits the ground, $y = 0$

$$\therefore 0 = -\frac{1}{25}(x-15)^2 + 9$$

$$\frac{1}{25}(x-15)^2 = 9$$

$$(x-15)^2 = 9 \times 25$$

$$(x-15)^2 = 225$$

$$x-15 = \pm \sqrt{225}$$

$$x-15 = -15 \quad \text{or} \quad x-15 = 15$$

$$x = 0, 30.$$

Ball hits the ground 30 m away.

Q3. Let $x = \text{Megan's age}$
 $\therefore x + 5 = \text{Thomas' age}$

$$(a) \quad x(x+5) - 2 = 8x + 16$$

$$(b) \quad x^2 + 5x - 2 = 8x + 16$$

$$x^2 + 5x - 8x - 2 - 16 = 0$$

$$x^2 - 3x - 18 = 0$$

$$(x-6)(x+3) = 0$$

$$x = 6, -3$$

Reject $x = -3$ since x must be positive

$\therefore x = 6$ \therefore Megan is 6 and Thomas is 11.

$$Q4. (a) \quad y = -0.1x^2 + 3x$$

$$\text{Let } y = 0 \quad 0 = -0.1x^2 + 3x$$

$$0 = x(-0.1x + 3)$$

\downarrow

$$x = 0$$

\downarrow

$$3 - 0.1x = 0$$

$$\therefore x = 0, 30.$$

It is 30 m away.

Q4 (b) Let $y = 20$.

$$-0.1x^2 + 3x = 20$$

$$-0.1x^2 + 3x - 20 = 0$$

Multiply through by -10 :

$$x^2 - 30x + 200 = 0$$

Factors of 200 that
add up to -30 are
 $-10, -20$

$$(x - 10)(x - 20) = 0$$

↓

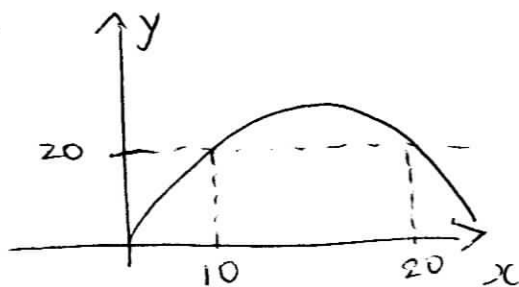
$$x = 10$$

↓

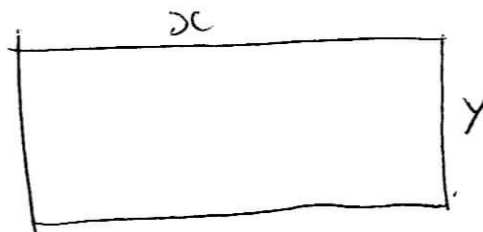
$$x = 20$$

∴ When the ball first reaches a height of 20m,

$$x = 10.$$



Q5.



$$(a) 2x + 2y = 50$$

$$P = 2(x + y)$$

$$(b) 2(x + y) = 50$$

$$x + y = 25$$

$$\therefore y = 25 - x$$

$$Q5(c) \quad A = xy$$

$$(d) \quad \text{Since } y = 25 - x$$

$$A = x(25 - x)$$

$$(e) \quad A = 25x - x^2$$

$$(f) \quad 154 = 25x - x^2$$

$$\therefore x^2 - 25x + 154 = 0.$$

Factors of 154 that add up to -25
are -11 and -14

$$(x - 11)(x - 14) = 0$$

$$x = 11, 14$$

(5)

x	$A = x(25 - x)$
1	$24 \times 1 = 24$
2	$2 \times 23 = 46$
3	$3 \times 22 = 66$
4	$4 \times 21 = 84$
5	$5 \times 20 = 100$
6	$6 \times 19 = 104$
7	$7 \times 18 = 126$
8	$8 \times 17 = 136$
9	$9 \times 16 = 144$
10	$10 \times 15 = 150$
11	$11 \times 14 = 154$
12	$12 \times 13 = 156$
13	$13 \times 12 = 156$

∴ Greatest area = 156 m^2
when $x = 12, y = 13$.

x	A
14	$14 \times 11 = 154$
15	$15 \times 10 = 150$