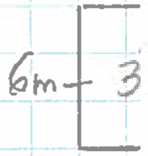
Day 1 Unit 2 **Geometry : Optimization Problems**

For a 4-sided rectangle:

1. a) A square has the minimum perimeter.



$A = s^2$ $\quad A = 36$ $\qquad P = 4s$

$s^2 = 36$ $\qquad\qquad = 4(6)$

$s = 6\text{ m}$ $\qquad\qquad = 24\text{ m}$

b) A 6 m by 6 m square gives minimum fencin

c) A square.

d) 1. Use $A = s^2$ formula for area of a square

2. Sub. for A, calculate s. $s = \sqrt{A}$

3. Use $P = 4s$ formula for perimeter

4. Sub for s. Calculate P.

$A = 220.25\text{ m}^2$ $\qquad$ 3. $P = 4s$

1. $s^2 = 220.25$ $\qquad$ 4. $P = 4(14.8)$

2. $s = \sqrt{220.25}$ $\qquad = 59.2$

$s \doteq 14.8$

$\therefore$ minimum perimeter of the garden is 59.2

$A = 27\text{ m}^2$

1. $A = s^2$ $\qquad$ 3. $P = 4s$

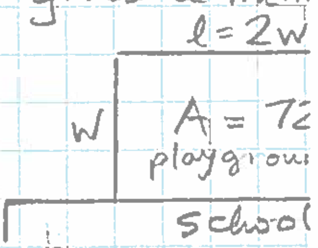
2. $s^2 = 27$ $\qquad$ 4. $P = 4(5.2)$

$s = \sqrt{27}$ $\qquad = 20.8$

$s \doteq 5.2$

$\therefore$ minimum perimeter of the garden is 20.8

2. For a 3-sided rectangle when the length is twice the width it gives a mini perimeter.



a) $A = lw$ $\quad A = 72$

$A = (2w)w$

$(2w)(w) = 72$ $\qquad l = 2w$

$2w^2 = 72$ $\qquad = 2(6)$

$w^2 = 36$ $\qquad = 12$

$w = 6$

$P = l + 2w$

$= 12 + 2($

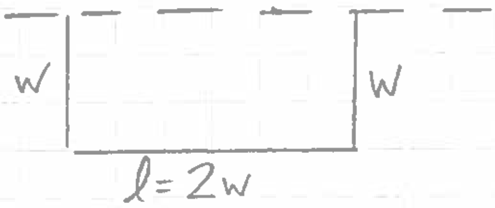
$= 24$

$\therefore$ minimum perimeter is 24m

2 b) Dimensions 6m by 12m give the minimum amount of fencing.

c) A rectangle with a length that is twice the wid[...] gives a minimum amount of fencing. (2 widths + 1 le[...]

d) $l = 2w$



$P = l + 2w$
$= 2w + 2w$
$= 4w$

* e) $A = lw$
$A = (2w)w$
$A = 2w^2$ is the formula for area of a rectangle minimum perimeter.

① * $A = 2w^2$ $A = 50m^2$
$2w^2 = 50$
$w^2 = 25$
$w = 5$

$l = 2w$
$= 2(5)$
$= 10$

$P = l + 2w$
$= 2w + 2w$
$= 4w$
$= 4(5)$
$= 20$.

∴ minimum perimeter for fencing is 20 m.

② $A = 2w^2$ $A = 112.5m^2$
$2w^2 = 112.5$
$w^2 = 56.25$
$w = \sqrt{56.25}$
$w = 7.5$

$P = 4w$
$= 4(7.5)$
$= 30$

∴ minimum perimeter for fencing is 30m

3. Surface Area of a rectangular based prism.

a) The optimum shape of a rectangular-based prism to minimize the surface area (and maximize t[...] is a cube (height = side length of base).

b) $V = s^3$ $V = 343cm^3$ ∴ the cube has dimens[...] 7cm by 7cm by 7cm.
$s^3 = 343$
$s = \sqrt[3]{343}$
$s = 7$

3. c) The cube with height = side length of base is a maximum volume

d) Formula for minimum surface area and ma
Volume:

$$SA \text{ of each face} = s^2$$
$$SA \text{ of } 6 \text{ faces} = 6s^2$$

$\therefore$ $SA = 6s^2$ is the formula for the surfac of a cube, which gives a minimum sur and maximum volume.

① $V = 729$ $\quad V = s^3$

$s^3 = 729$
$s = \sqrt[3]{729}$
$s = 9$

$SA = 6s^2$
$= 6(9)^2$
$= 486$

$\therefore$ minimum surface area of the cube is 486

② $V = 1500$ $\quad V = s^3$

$s^3 = 1500$
$s = \sqrt[3]{1500}$
$s \doteq 11.4$

$SA = 6s^2$
$= 6(11.4)^2$
$\doteq 779.8$

$\therefore$ minimum surface area of the cube is