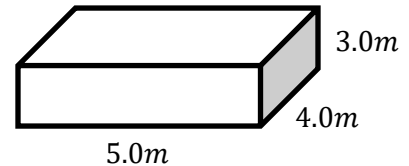## Section 3.3 – Practice Problems

1. You are starting a business and need various sizes of rectangular boxes (including lids). If the original box size is: $length = 5in, width = 4in,\ height = 3in$

   a) What is the surface area of the original box?

   $$SA = 2lw + 2lh + 2wh$$
   $$= 2(5)(4) + 2(5)(3) + 2(4)(3)$$
   $$= 40 + 30 + 24$$
   $$\boxed{94\,m^2}$$

   3.0m
   4.0m
   5.0m

   b) What happens to the surface area if we double the length and the width?

   $l = 10$
   $w = 8$

   $$2(8)(10) + 2(10)(3) + 2(8)(3)$$
   $$160 + 60 + 48$$
   $$\boxed{268\,m^2}$$

   It increases by:
   $174\,n^2$

   c) How does the surface area change if the height and length are tripled?

   $h = 9$
   $l = 15$

   $$2(15)(4) + 2(15)(9) + 2(4)(9)$$
   $$120 + 270 + 72$$
   $$\boxed{462\,m^2}$$

   Increases by:
   $368\,m^2$

   d) If each side was multiplied by a factor of 4, what is the new surface area?

   $l = 20$
   $w = 16$
   $h = 12$

   $$2(20)(16) + 2(16)(12) + 2(20)(12)$$
   $$640 + 384 + 480$$
   $$\boxed{1504\,m^2}$$

   surface area
   increases by factor
   of $4^2 = 16$

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2. Using the dimensions from the previous question, what happens to the surface area of the box if all sides are halved (divided by 2)?

$\ell = 2.5$
$w = 2$
$h = 1.5$

$2(2.5)(2) + 2(2.5)(1.5) + 2(2)(1.5)$

$10 \qquad + 7.5 \qquad + \quad 6$
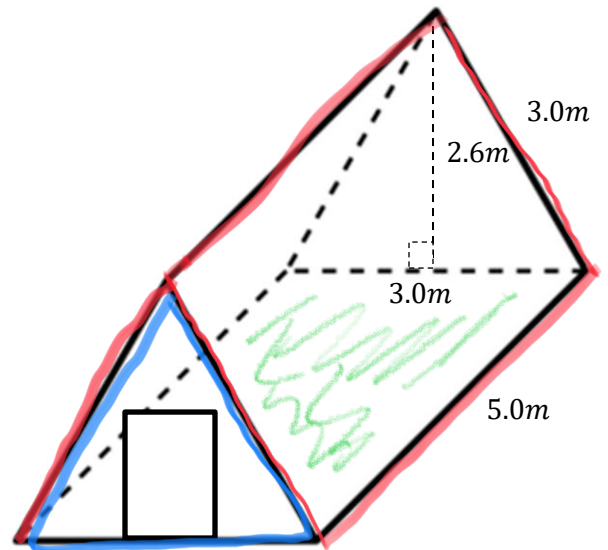
$\boxed{23.5m^2}$

$\boxed{Area\ reduced\ by\ \frac{1}{4} = (\frac{1}{2})^2}$

3. Jim is going to build a tree house in the shape of a triangular prism. It costs $35/m^2$ of surface area. He is considering changing the depth from $5.0m$ to $7.0m$.

    a) What is the surface area of the original?

$SA = 5 \cdot 3 + (5 \cdot 3)2 + \dfrac{(3 \cdot 2.6)(2)}{2}$

$15 + 30 + 7.8$

$= \boxed{52.8 m^2}$

3.0m
2.6m
3.0m
5.0m

    b) What is the surface area of the larger plan?

$7 \cdot 3 + (7 \cdot 3)2 + \dfrac{(3 \cdot 2.6)2}{2}$

$= 21 + 42 + 7.8$

$= \boxed{70.8 m^2}$

c) What is the difference in the Surface Areas?

$$70.8 - 52.8 = \boxed{18 m^2}$$

d) How much would it cost to increase the depth?

Since there are $18m^2$ difference the larger version would be:

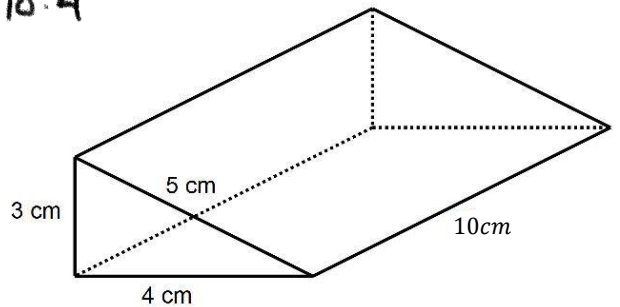$$18 \times 35\!\!\!\!\!/_2 = \boxed{\$630}$$

4. If you were to double or halve the length ($10cm$) of the following image, how would by how much would the Surface Area change with respect to the original?

Original: $10 \cdot 3 + \dfrac{(3 \cdot 4)2}{2} + 5 \cdot 10 + 10 \cdot 4$

$$= 30 + 12 + 50 + 40$$

$$= \boxed{132 \, cm^2}$$

3 cm

5 cm

4 cm

10cm

Double: $20 \cdot 3 + 12 + 5 \cdot 20 + 20 \cdot 4$

$$= 60 + 12 + 100 + 80$$

$$= \boxed{252 \, cm^2}$$

Increases by: $120 cm^2$

Half: $5 \cdot 3 + \dfrac{(3 \cdot 4)2}{2} + 5 \cdot 5 + 5 \cdot 4$

$$= 15 + 12 + 25 + 20$$

$$= \boxed{72 \, cm^2}$$

Decreases by: $60 cm^2$

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