**Lesson 3.4 Modelling With Formulas**

Formulas describe an algebraic relationship between two variables. Today we will be reviewing how to insert values and find out information from a formula. We will also look at rearranging and solving formulas to find unknown information.

**Minds-On:**

The higher your altitude, the farther you can see. This relationship can be modelled by the formula

 $d=2\sqrt{3.2h}$

Where $h$ is your height, in meteres, above the ground and $d$ is the distance, in kilometres, to the horizon.

Consider the CN tower.

1. How far can you see from the restaurant which is 351 m high? Round your answer to the nearest kilometer.
2. How far can you see from the observation deck which is 447 m high? Round your answer to the nearest kilometer.
3. How high would you have to be in order to see 100 km away? Round your answer to the nearest metre.
4. Explain how you found your answer.
5. Can you create a formula to find the height you must be, dependent on the distance you would like to see?

**Example 1:**

1. The circumference of a circle can be found by using the formula $C=2πr$. Rearrange this formula to isolate $r$ (that is, determine an equation to represent the radius if the circumference is known).
2. The speed of a car can be found by using the formula $s=\frac{d}{t}$, where $s$ is the speed in kilometres/hour, $d$ is the distance in kilometres, and $t$ is the time in hours. Determine an equation to find the distance travelled depending on the speed and time.
3. The area of a circle can be found using the formula $A=πr^{2}$. Determine a formula for finding the radius given the area.

**Practice:**

1. Rearrange each formula to isolate the variable indicated.
	1. $C=πd$ for $d$ (circumference of a circle)
	2. $d=vt$ for $t$ (distance – distance = speed multiplied by time)
	3. $A=P+I$ for $I $(investments – total amount = principle plus interest)
	4. $F=ma$ for $a$ (Force = mass X acceleration)
	5. $V=IR$ for $R$ (voltage = current X resistance)
	6. $V=s^{3}$ for $s$ (volume of a cube = side length cubed)
	7. $P=I^{2}R$ for $R$ (Power = current squared X resistance)
	8. $V=πr^{2}h$ for $h$ (Volume of a cylinder = pi X radius squared X height of cylinder)
	9. $P=2l+2w$ for $l$ (Perimeter of a rectangle = 2 lengths + 2 widths)
	10. $A=\frac{bh}{2}$ for $h$ (area of a triangle = base X height divided by 2)
	11. $c^{2}=a^{2}+b^{2}$ for $a$ (Pythagorean theorem)
2. You can use the formula $p=2.2k $ to obtain an approximate value for converting a mass, $k$, in kilograms to mass in pounds, $p.$
	1. Use the formula to find the number of pound in 3 kg.
	2. Rearrange the formula to express the $k$ in terms of $p$. (ie. To find the kilograms based on pounds).
	3. How many kilograms are in 8 pounds? Round your answer to the nearest tenth of a kilogram.
3. The surface area, $A$, of a cube is related to the length of a side of the cube, $s$, by the formula $A=6s^{2}.$
	1. Rearrange this formula to express the side length in terms of the area.
	2. Find the length of the side of cube with a surface area of 800 $cm^{2}$. Round your answer to the nearest tenth of a centimetre.
4. Bill is a hotel manager. His responsibilities include renting rooms for conferences. The hotel charges $250 per day plus $15 per person for the grand ballroom.
	1. Create a formula that relates the cost, $C,$in dollars of renting the ballroom to the number of people, $n.$ Assume the rental is for 1 day.
	2. How much should Bill charge to rent the hall for
		1. 50 people?
		2. 100 people?
	3. Rearrange your formula to find the number of people, $n, $in terms of the cost, $C$.
	4. How many people could attend a wedding reception if the wedding planners have a budget of
		1. $4000?
		2. $2000?