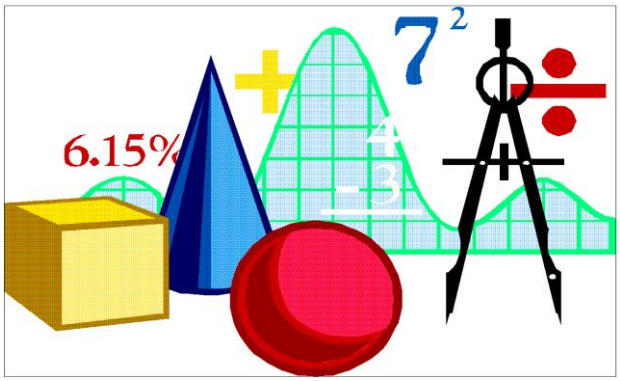
VARLEY
EXCELLENCE SINCE 1886

Electrotechnology
Automotive & Heavy Machinery
Aerospace
Marine
Metals
me program
THE LIVING TOOLBOX



me program

THE MATHEMATICS OF FIRE TRUCKS

STEP 4 - MATHEMATICS

MEASUREMENT CHALLENGE

Weighting: 25%

Due Date:

MEASUREMENT

MEASUREMENT OUTCOMES

MS4.1 Uses formulae and Pythagoras' theorem in calculating perimeter and area of circles and figures composed of rectangles and triangles

MS4.2 Calculates surface area of rectangular and triangular prisms and volume of right prisms and cylinders

42M Telescopic ladder platform fire truck

Ladder length	42 metres

MEASUREMENT

Vehicle Length	10.97 metres
Vehicle Height (to the top of the cab)	3.65 metres
Vehicle mass	30,600kg

This fire truck was custom designed by Varley Group for the Queensland Fire and Rescue Service. One of its major design features is its ladder which can be extended to a maximum length of 42m. The ladder has a bend at 21m (as seen in the picture below) allowing fire fighters to place themselves in the most effective position when attacking and putting out a blaze. The base of the ladder is mounted on the back of the truck 3.65m above the ground.

Q. There is a fire in a high rise building, which is estimated to be 44m above the ground. Will the ladder extend straight up parallel to the building to reach this height? Why or why not? (Draw a diagram to support your argument).

Q. The Queensland Fire and Rescue Service have been alerted to a fire in a high rise apartment in the middle of Surfers Paradise. Due to obstacles around the building the fire truck cannot drive within 10m of the building. Therefore the base of the ladder is 10m away from the building. If the ladder is fully extended and leaning against the building, how high up the building does the ladder reach? Will

the fire fighters be able to reach the fire which is 41m high? (Draw a diagram to support your argument).

Q. The Queensland Fire and Rescue have had a call out to a house fire in the western suburbs of the Gold Coast. The fire is on ground level; however the fire fighters want to use the ladder to fight the fire from above, as they believe that this will increase their chance of containing the fire as quickly as possible. If the ladder is bent at an angle of 90^{O} and a fire fighter is standing on the tip of a ladder fighting the fire, how far is he from the base of the ladder. Draw a diagram representing all of this information to help you work out the question.

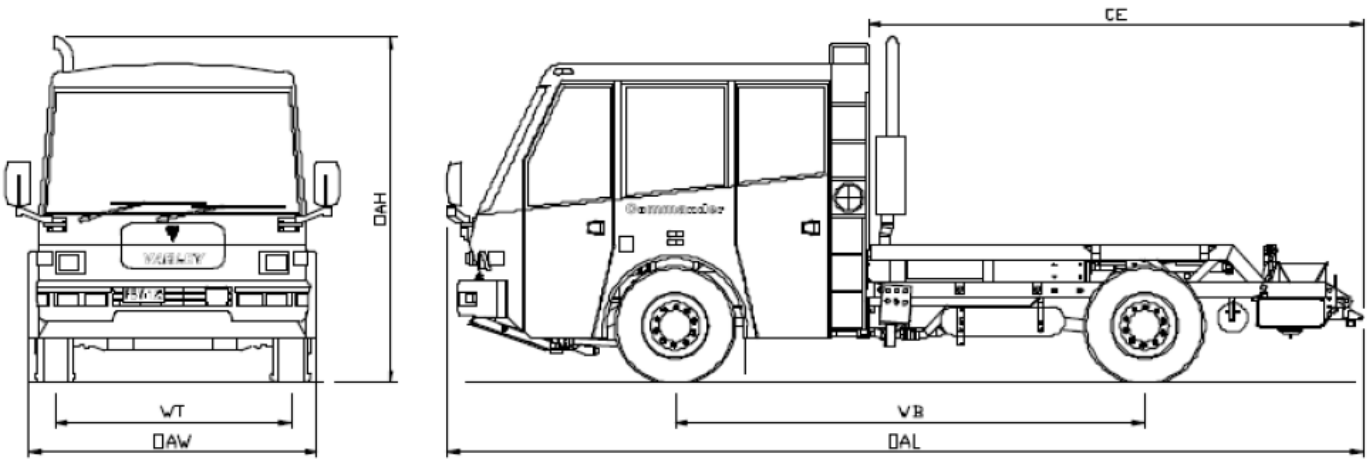
MEASUREMENT

Varley Fire Commander

MEASUREMENT

Below there is a table and a diagram that highlight the dimensions of the Varley Fire Commander.

RATINGS	TARE MASS (kg)			DIMENSIONS (mm)							TURNING CIRCLE
GVM	Total	Front	Rear	OAL	WB	WTF	WTR	OAH	OAW	CE	Kerb to Kerb
1700	7400	4300	3100	7800	4050	2020	1900	3200	2470	4250	15.5m



The dimensions of the truck appear in mm. Convert these lengths into centimetres, and write them into the table below.

Dimensions (cm)						
OAL	WB	WTF	WTR	OAH	OAW	CE

Once you have completed this table, write these dimensions onto the appropriate spot on the diagram.

Trident 6000

Water Tank Volume	5400L
Vehicle Length	8805mm
Vehicle Weight (loaded)	20544kg
Vehicle Height	3600mm
Vehicle Width	3000mm

This specialised fire rescue vehicles is the primary response vehicle of the Aviation Rescue and Fire fighting Service (ARFS) and the Royal Australian Air Force (RAAF). This is due to its large water

carrying capacity and its speed and acceleration. Also the trident 600 has been designed to allow for one man operation due to its simple layout and minimum control functions.

Q. Let's assume that the water tank on this truck is cylindrical.

a) State the formula for the volume of a cylinder.

b) Due to size restrictions in the rear compartment of the truck, the height of the tanks must be 2400mm. Find the diameter of the water tank in centimetres. Draw the tank and label all necessary dimensions. (Drawing a unit conversion table, may help with your calculations)

c) Draw the net of the cylindrical water tank and label its dimensions.

d) Find the surface area of the cylindrical water tank.

MEASUREMENT

Q. Let's assume now that the tank on this truck takes the shape of a rectangular prism.

a) State the formula for the volume of a rectangular prism.

b) Due to size restrictions in the rear compartment of the truck, the length of the tank must be 2400mm, and the width of the water tank is 700mm respectively. Find the height of the water tank in centimetres. Draw the tank and label all necessary dimensions.

c) Draw the net of the rectangular prism water tank and label the dimensions onto the net drawing.

d) Find the surface area of the rectangular tank.

Q. When building the water tank, manufacturers such as Varley Group are always in search of a material that is strong, light and cheap. The current material of choice is Polyprene. This material fits all of these three categories and is also resistant to extreme heats. If Polyprene costs $52.20 per square meter how much will each tank cost to construct? Is the cylindrical or rectangular shaped tank more economical to construct?

Light Attack Appliances – Fire Engine Water Carrier

Water Tank Volume	1000L

Q4. This specialised fire rescue vehicles is designed to be a light weight water carrier. It has two 30m hoses that are stored on circular hose reels of diameter 30cm (see picture below). After extinguishing a fire, a fire fighter must wind up one of these hoses. How many turns of the reel are needed to wind up the hose?

MEASUREMENT

Q. A fire fighter is filling the cylindrical tank of volume 1000L. She's pumping at a rate of 44 litres per minute. How long will it take her to fill the tank (to the nearest minute)?

MEASUREMENT

MEASUREMENT

MEASUREMENT

MEASUREMENT