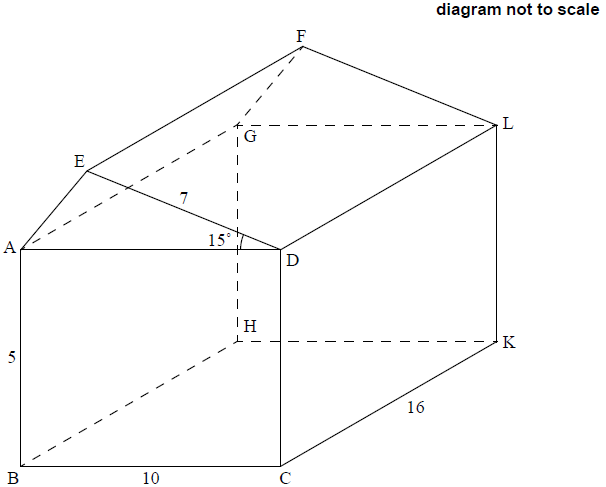
# 1.1 using standard form\_P\_2

**1a.** *[3 marks]*

Farmer Brown has built a new barn, on horizontal ground, on his farm. The barn has a cuboid base and a triangular prism roof, as shown in the diagram.



The cuboid has a width of 10 m, a length of 16 m and a height of 5 m.  
The roof has two sloping faces and two vertical and identical sides, ADE and GLF.  
The face DEFL slopes at an angle of 15° to the horizontal and ED = 7 m .

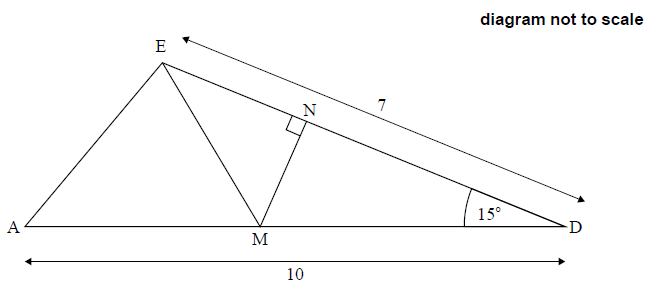
Calculate the area of triangle EAD.

**1b.** *[3 marks]*

Calculate the **total** volume of the barn.

**1c.** *[2 marks]*

The roof was built using metal supports. Each support is made from **five** lengths of metal AE, ED, AD, EM and MN, and the design is shown in the following diagram.



ED = 7 m , AD = 10 m and angle ADE = 15° .  
M is the midpoint of AD.  
N is the point on ED such that MN is at right angles to ED.

Calculate the length of MN.

**1d.** *[3 marks]*

Calculate the length of AE.



**1e.** *[3 marks]*

Farmer Brown believes that N is the midpoint of ED.

Show that Farmer Brown is incorrect.

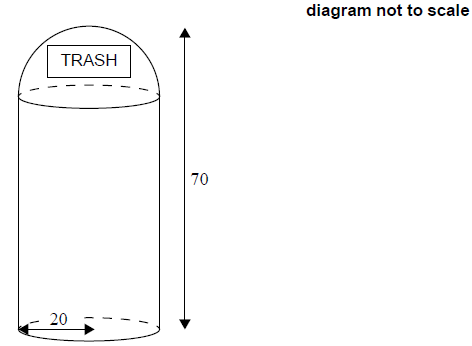


**1f.** *[4 marks]*

Calculate the **total** length of metal required for one support.

**2a.** *[1 mark]*

A manufacturer makes trash cans in the form of a cylinder with a hemispherical top. The trash can has a height of 70 cm. The base radius of both the cylinder and the hemispherical top is 20 cm.



Write down the height of the cylinder.

**2b.** *[4 marks]*

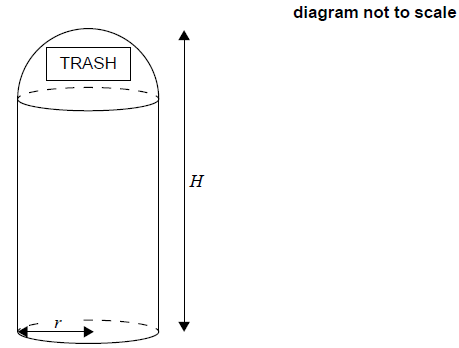
Find the total volume of the trash can.

**2c.** *[2 marks]*

A designer is asked to produce a new trash can.

The new trash can will also be in the form of a cylinder with a hemispherical top.

This trash can will have a height of *H* cm and a base radius of *r* cm.



There is a design constraint such that *H* + 2*r* = 110 cm.

The designer has to maximize the volume of the trash can.

Find the height of the **cylinder**, *h* , of the new trash can, in terms of *r*.



**2d.** *[3 marks]*

Show that the volume, *V* cm , of the new trash can is given by

.



**2e.** *[2 marks]*

Using your graphic display calculator, find the value of *r* which maximizes the value of *V*.

**2f.** *[4 marks]*

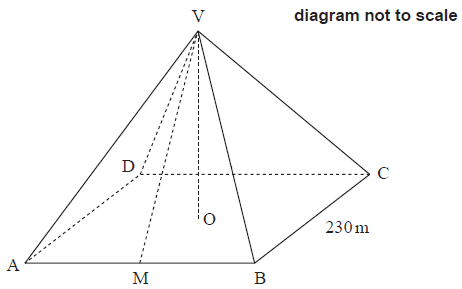
The designer claims that the new trash can has a capacity that is at least 40% greater than the capacity of the original trash can.

State whether the designer’s claim is correct. Justify your answer.

**3a.** *[3 marks]*

The Great Pyramid of Giza in Egypt is a right pyramid with a square base. The pyramid is made of solid stone. The sides of the base are  long. The diagram below represents this pyramid, labelled .

 is the vertex of the pyramid.  is the centre of the base,  .  is the midpoint of . Angle  .



Show that the length of  is  metres, correct to three significant figures.



**3b.** *[2 marks]*

Calculate the height of the pyramid,  .



**3c.** *[2 marks]*

Find the volume of the pyramid.



**3d.** *[2 marks]*

Write down your answer to part (c) in the form   where  and  .

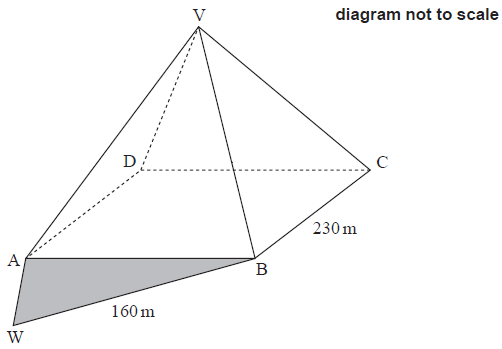
**3e.** *[4 marks]*

Ahmad is a tour guide at the Great Pyramid of Giza. He claims that the amount of stone used to build the pyramid could build a wall  metres high and  metre wide stretching from Paris to Amsterdam, which are  apart.

Determine whether Ahmad’s claim is correct. Give a reason.

**3f.** *[6 marks]*

Ahmad and his friends like to sit in the pyramid’s shadow, , to cool down.  
At mid-afternoon,   and angle 



i)     Calculate the length of  at mid-afternoon.

ii)    Calculate the area of the shadow, , at mid-afternoon.

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