MATHEMATICAL LITERACY
Grade 12

MEASUREMENT

02 JULY 2014

Check List

Make sure you …..

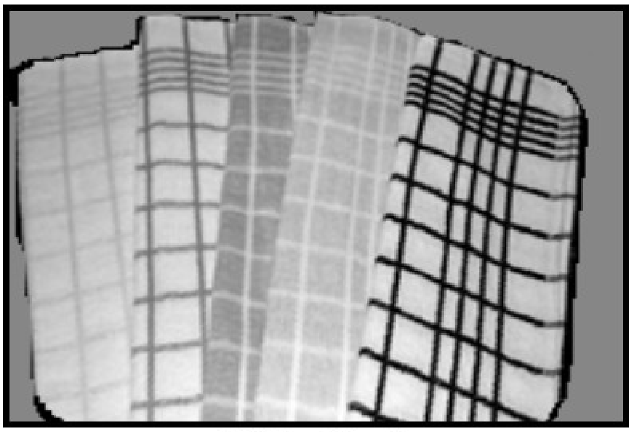
- Can convert between different units of measurement
- Are able to perform calculations with measurements of length, volume, area, weight and temperature
- Can apply your know of measure to solve practical tasks cost effectively
- Are able to work with different measurements of time.

Exam Questions

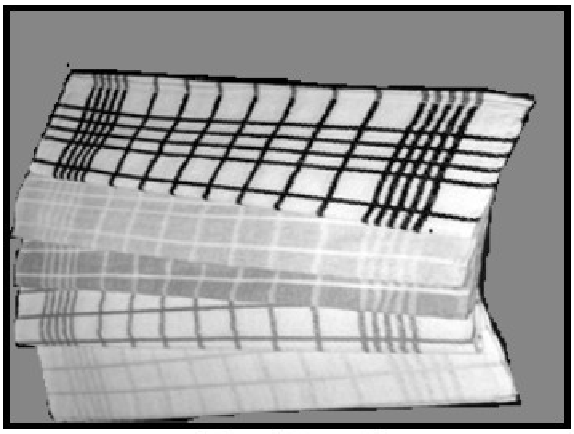
Question 1

(Adapted from DBE Feb 2014 Paper 1, Question 6)

Petra buys some material to make dish cloths and tea towels which she sells at a local flea market. The material she buys has a fixed width of 120 cm and is cut into any required length. She cuts the material into rectangular pieces of 30 cm × 45 cm to make the tea towels and 30 cm × 30 cm to make the dish cloths, as shown in the photographs below.



Dish Cloth



Tea Towel

1.1 Calculate the area of the material needed to make ONE tea towel.

You may use the formula:

Area of a rectangle = length × breadth (2)

1.2 Petra wants to make a decorative border on some of the tea towels.

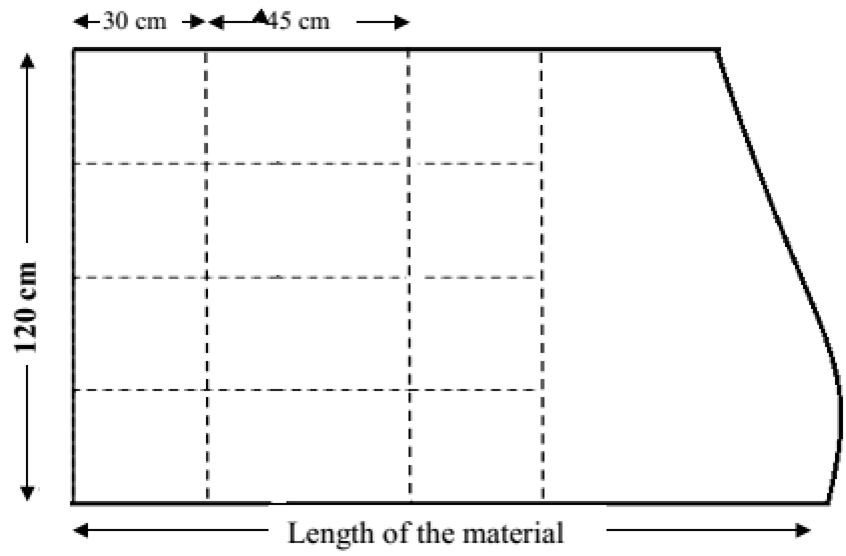
Calculate the perimeter of a tea towel.

You may use the formula:

Perimeter of a rectangle = 2(length + breadth) (2)

To make the dish cloths and tea towels she uses the cutting layout as shown in the sketch below.

Cutting layout for dish cloths and tea towels using dotted lines:



1.3 Determine the minimum length of material that Petra will need if she wants to make exactly 4 dish cloths and 4 tea towels. (2)

1.4 Determine the maximum number of dish cloths and tea towels she can make if she has a piece of material that is exactly 180 cm long. You need to make sure that no material is wasted. (3)

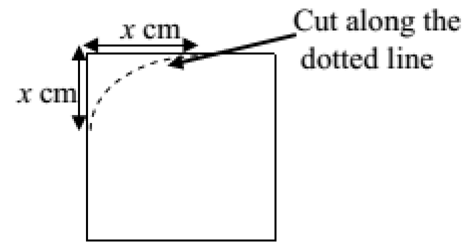
The edges of the dish cloths are stitched, making the corners round as shown in the diagram

To calculate the area of the finished dish cloth, she uses

the following formula:

Area (in cm^2) = $900 - x^2(4 - \pi)$

(x is the distance from the side of the square where she starts to make the corners round.)



1.5 Calculate the area of ONE finished dish cloth if $x = 3$ and using $\pi = 3,14$. (3)

Petra buys the material at R45,00 per metre. She uses the table below to help her calculate the cost of the material required.

Table 1: Cost of the material for different lengths

Length of material (in metres)	0	2	4	5	7	B	10
Cost (in rand)	0	90	180	A	315	360	450

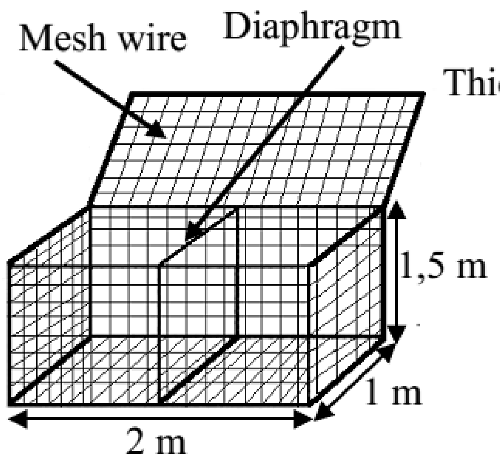
1.6 Calculate the missing values A and B. (4)

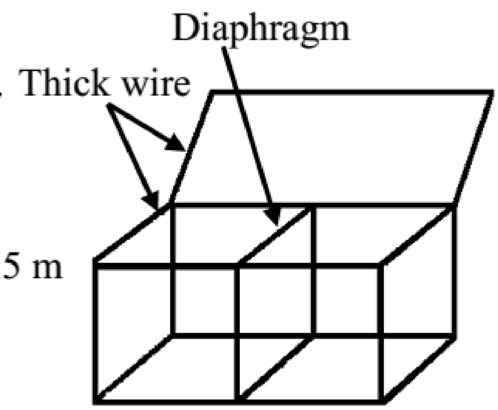
1.7 Draw a line graph that represents the relationship between the length and the cost of the material. (4)

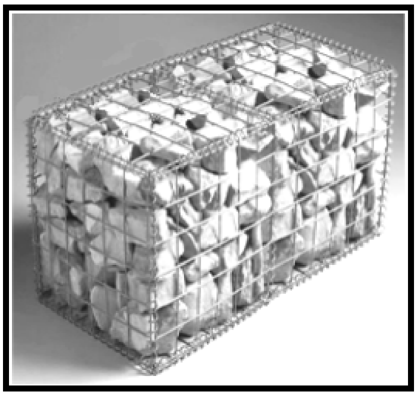
Question 2

(Adapted from DBE Feb 2014 Paper 1, Question 6)

The Baviaanskloof Mega Reserve (BMR), situated in the Eastern Cape, was declared a World Heritage Site in 2004. The farmers in the BMR are also concerned about soil erosion. They decide to build gabion baskets (big cages) and use them to prevent further soil erosion. Diagrams and a photograph of a gabion basket are shown below.







The dimensions of the gabion basket are:

L = Length = 2 m B = Breadth = 1 m H = Height = 1,5 m

The centre panel of the gabion basket is called the diaphragm.

2.1 Determine the total length of the thick wire required to build the frame of the gabion basket. (4)

2.2 Use the following formula to calculate the total area of the mesh wire required to make a gabion basket:

Total area of mesh wire = 3 × B × H + 2 × L(H + B) (3)

The farmers want to determine the cost of the mesh wire that is needed to cover 20 gabion baskets. The total area to cover 20 baskets (including allowance for overlaps) is 699,3 m² and the cost of the mesh wire is R59,95 per m².

2.3 Calculate the total cost of the mesh wire needed for the 20 baskets, rounded off to the nearest R10. (3)

The farmers decide to build a bigger gabion basket but to keep the ratio of the dimensions of the original gabion basket the same, that is

L : B : H = 2 : 1 : 1,5

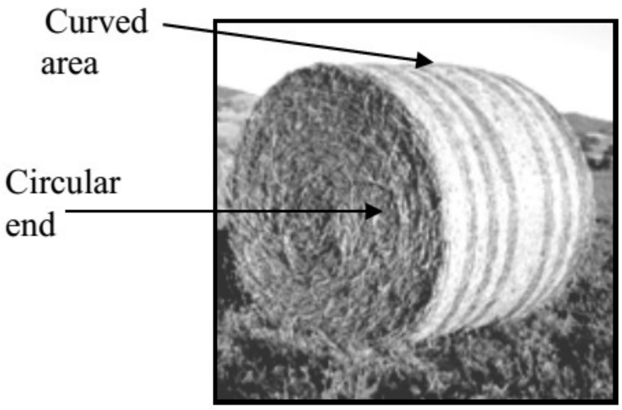
2.4 Calculate the height of the new gabion basket if it has a length of 3 m. (2)

2.5 Write down the ratio of the area of the original diaphragm to the area of the diaphragm in the bigger gabion baskets (4)

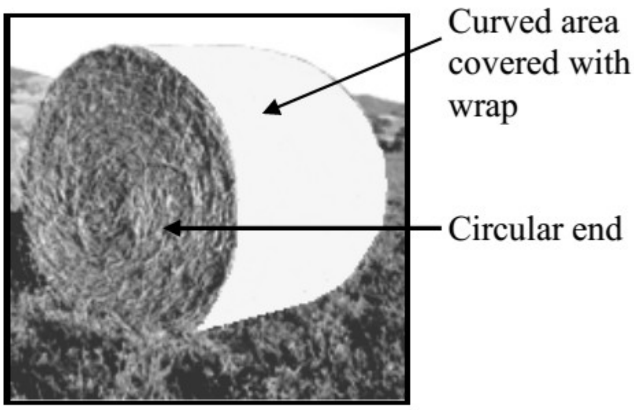
Question 3

Mathys is the owner of Roseleigh farm. He makes bales of hay in order to feed his livestock (cattle, sheep and horses) during winter. [Hay is a mixture of grass, clover, barley and wheat plant materials.]The hay is allowed to dry and then picked up by machines to be processed into cylindrical bales. A cylindrical bale has a curved side and two circular ends, as shown in the photographs below.The curved side of each bale is covered with a rectangular wrap in order to control moisture. The wrap repels moisture but leaves the circular ends exposed so that the hay can breathe.

Photograph of cylindrical bale of hay



Photograph of wrapped cylindrical bale of hay



3.1 Each cylindrical bale has a radius of 70 cm. Its height is the same length as the diameter.

The area of the wrap is 6% more than the curved area of the cylindrical bale.

Calculate the area of the wrap required to cover the curved area of ONE bale.

The following formula may be used:

Curved area of a cylinder = 2 x π x r x h

Use π = 3,14, where r = radius of the cylinder and h = height of the cylinder. (6)

3.2 The bales must conform to a standard ratio of volume to total surface area that is less than 25 : 1.

Determine, by calculation, whether Mathys's bales conform to the standard ratio.

The following formulas may be used:

Volume of a cylinder = π x r^2 x h

Total surface area of a cylinder = 2 x π x r (r + h)

Use π = 3,14, where r = radius of the cylinder and h = height of the cylinder. (6)

The temperature of each bale must be controlled to prevent fermentation (decay due to moisture) and combustion (burning due to dryness). The table below gives guidelines for actions to be taken for different bale temperatures.

Table 2: Guidelines for actions to be taken for different bale temperatures

Bale temperatures	Action to be taken
Lower than 120 °F	None
120 °F to 140 °F	Separate from the rest of the bales to cool off
Higher than 140 °F	Separate from the rest of the bales and destroy

Mathys measures the temperature of a specific bale. He finds it to be 55 C ° and then destroys the bale.

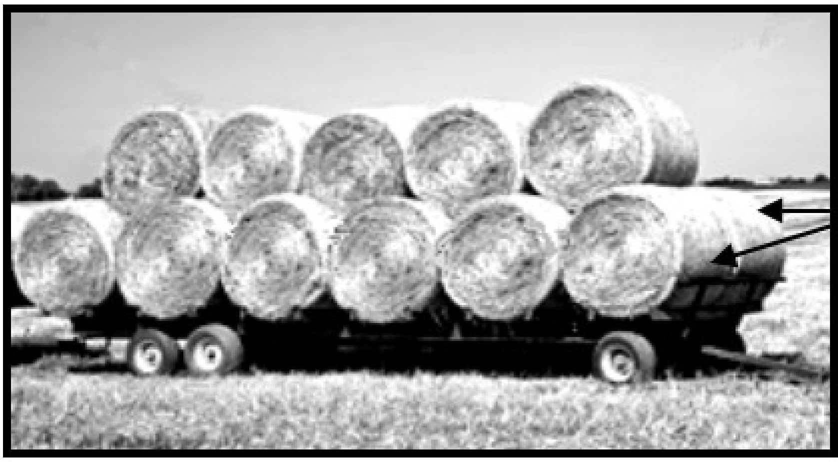
3.3 Determine, showing ALL the necessary calculations, whether the action taken by Mathys is correct.

The following formula may be used:

$$\text{Temperature in °F} = \frac{9}{5} \times \text{Temperature in °C} + 32°$$

(3)

Mathys has to transport the bales with a trailer. The photograph below shows an example of a stack of two layers of bales loaded onto a trailer.



Bottom layer with
2 rows of bales

Only the bottom layer of bales on the trailer consists of two rows of 6 bales each to ensure balance. The 2nd layer of bales on the trailer consists of one row of 5 bales. Each subsequent layer that has to be stacked has one less bale than the previous layer.

3.4 Determine the total number of bales that can be loaded onto the trailer in this way if FOUR layers of bales are to be stacked. (5)

Mathys calculates that each cow needs to be fed an average of 12 kg of hay daily. Each bale weighs 1 440 kg.

3.5 Determine the maximum number of days one bale will last if it is used to feed 10 cows. (3)

3.6 Write down a simplified formula that can be used to calculate the maximum number of days one bale will last if it is used to feed a number of cows. (3)

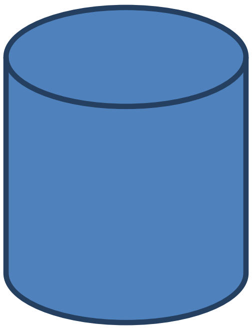
3.7 Use the equation obtained in Question 3.6 to draw a graph, on showing the maximum number of days one bale can last if it is used to feed a number of cows. (5)

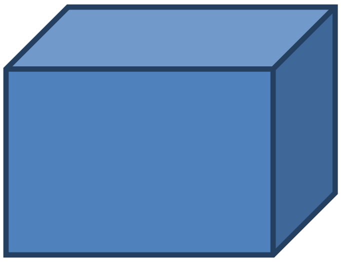
Mathys has a herd of 150 dairy cows. He needs to prepare hay to last from 1st May to 31st August . He estimates that he needs 6 trailer loads of hay

3.8 Show by doing calculations in Mathys's estimate is correct or not? (5)

Test Yourself

Consider the following diagrams when answering questions 1 – 5





The diagrams illustrate a round tin (13cm high and 8cm in diameter) and a rectangular tin with measurements 8 cm long, 7cm wide and 6 cm high.

Question 1

The round tin has a surface area of:

A. 401,92 cm^2
B. 414,48 cm^2
C. 427,04 cm^2
D. None of the above

Question 2

The surface area of the rectangular tin is:

A. 336 cm^2
B. 292 cm^2
C. 146 cm^2
D. None of the above

Question 3

What is the volume of the round tin?

A 423,9 cm^3

B 1 695,6 cm^3

C 847,8 cm^3

D None of the above

Question 4

What is the volume of the rectangular tin?

A 122,5 cm^3

B 112,5 cm^3

C 1125 cm^2

D None of the above

Question 5

Which has the greater volume to surface area ratio?

A The round tin

B The rectangular tin

C They are both the same

D None of the above