



**MATHEMATICS**

**0563/03**

Paper 3

**October/November 2016**

**2 hours 30 minutes**

Additional Materials:

Answer paper  
Electronic calculator  
Geometrical instruments

Graph Paper (3 sheets)  
Mathematical tables (optional)

**READ THESE INSTRUCTIONS FIRST**

Write your answers on the separate answer paper provided.

**Start each question on a fresh side of the page.**

Write your centre number, candidate number and name on each sheet of answer paper you use.

Answer **all** questions.

All working must be clearly shown. The working should be done on the same sheet as the rest of the answer. Marks will be given for working which shows that you know how to solve the problem even if you get the answer wrong.

At the end of the examination, fasten all your work securely together using the string provided.

Do not use staples, paper clips, highlighters, glue or correction fluid.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 125.

Electronic calculators may be used.

If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

In any question where the value of  $\pi$  is required, use the value from your calculator or take  $\pi$  as 3.142.

\*  
4  
2  
4  
1  
7  
4  
8  
4  
6  
0  
\*

## Mathematical formulae for paper 3

## Surface area and volume of solids

Name of solid	Total surface area	Volume
cone	$\pi r^2 + \pi r l$	$\frac{1}{3} \pi r^2 h$
pyramid		$\frac{1}{3}$ base area x height
sphere	$4\pi r^2$	$\frac{4}{3} \pi r^3$

## Trigonometry

Sine Rule  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangle  $= \frac{1}{2} ab \sin C$

Cosine Rule  $a^2 = b^2 + c^2 - 2bc \cos A$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

## Statistics

$$\text{Variance} = \frac{\sum(x-\bar{x})^2}{n}, \quad \frac{\sum f(x-\bar{x})^2}{\sum f}$$

$$\text{Standard deviation (SD)} = \sqrt{\text{Variance}} = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}, \quad \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}}$$

or  $\sqrt{\frac{\sum x^2}{n} - (\bar{x})^2}, \quad \sqrt{\frac{\sum fx^2}{\sum f} - (\bar{x})^2}$

- 1 A bus is filled to capacity with 70 paying passengers travelling from Kgakalo to Gaule. The distance from Kgakalo to Gaule is 228 km. The bus fare is 22.73 thebe per kilometre.
- (a) Calculate the total bus fare, to the nearest thebe, of all the paying passengers. [3]
- (b) At the start of the return journey, the bus was 80% full of paying passengers.
- (i) How many paying passengers were on the bus? [2]
- (ii) At Sateng, a village 120 km from Gaule, more paying passengers boarded the bus and it was filled to capacity.
- Calculate the total bus fare on the return journey. [3]
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- 2 The first four terms of a sequence are 0, 3, 12 and 27.
- (a) Write down the 5th term. [1]
- (b) What is the expression for the  $n$ th term? [3]
- (c) Calculate
- (i) the value of the 20th term, [2]
- (ii) the value of  $n$  for which the  $n$ th term is 675. [3]
- 

- 3 A wireless antenna is to be mounted inside a park. The park is in the form of a quadrilateral  $ABCD$  such that  $AB = DC = 75$  m,  $BC = AD = 60$  m and the size of  $\hat{ABC} = 123^\circ$ .
- (a) Using a scale of 1 cm to represent 10 m, construct a scale diagram of the park. [3]
- (b) What is the geometrical name of the shape of the park? [1]
- (c) The wireless antenna must be mounted such that it is 38 m from  $D$ . It should also be the same distance away from  $A$  as it is from  $D$ .
- Show by construction
- (i) the locus of points that are 38 m from  $D$ , [1]
- (ii) the locus of points that are the same distance from  $A$  as they are from  $D$ . [1]
- (d) Mark the position of the wireless antenna and label it  $E$ . [1]
-



- 5 A wholesaler sells two different makes of calculators, the Pelda and the Delca. The cost of a Pelda calculator is represented by  $Px$  and the cost of a Delca calculator is represented by  $Py$ .

(a) A tuckshop buys 4 Pelda calculators and 3 Delca calculators from the wholesaler.

(i) Express, in terms of  $x$  and  $y$ , the total cost of the 4 Pelda calculators and the 3 Delca calculators. [2]

(ii) The total cost of the 4 Pelda calculators and the 3 Delca calculators is P350.

Form an equation, in terms of  $x$  and  $y$ , to show this information. [1]

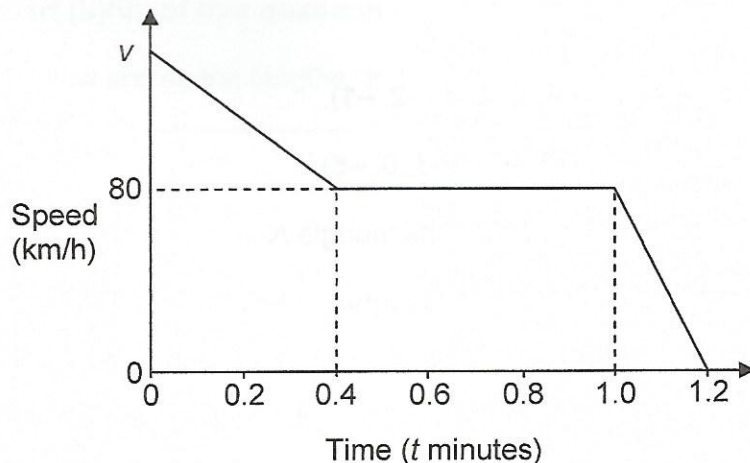
(b) Another tuckshop spent a total of P280 to buy 5 Pelda calculators and 2 Delca calculators from the wholesaler.

Form an equation, in terms of  $x$  and  $y$ , to show this information. [2]

(c) (i) Solve the equations in parts (a)(ii) and (b) simultaneously. [3]

(ii) Calculate the total cost of 3 Pelda calculators and 5 Delca calculators. [2]

- 6 The diagram below shows the speed–time graph of a bus. The bus decelerates from a speed of  $v$  km/h to 80 km/h during the first 0.4 minutes. It then moves at a constant speed for 0.6 minutes and finally decelerates for 0.2 minutes until it stops.



(a) The deceleration of the bus is  $2700 \text{ km/h}^2$  in the first 0.4 minutes.

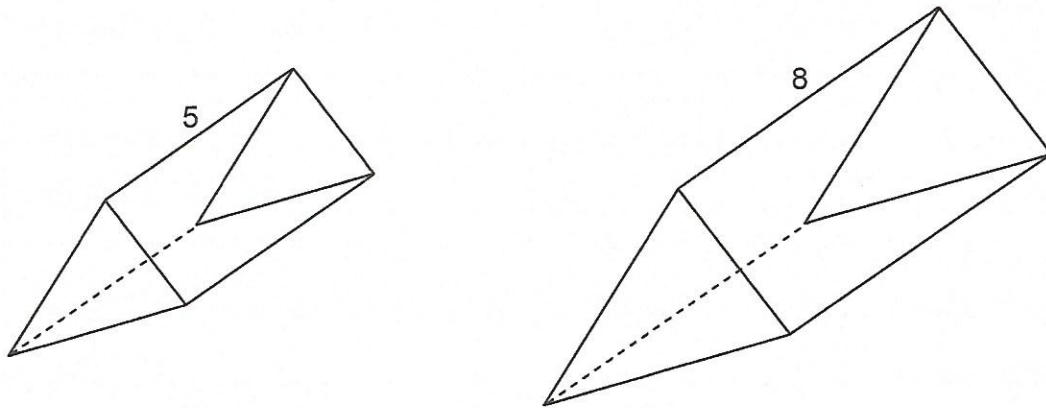
Calculate the value of  $v$ . [3]

(b) Calculate

(i) the deceleration, in  $\text{km/h}^2$ , of the bus when  $t = 1.1$  minutes, [2]

(ii) the total distance travelled between  $t = 0.4$  minutes and  $t = 1.2$  minutes. [2]

- 7 The diagram below shows two similar triangular prisms. The lengths of the triangular prisms are in the ratio 5 : 8.



- (a) The area of the cross-section of the smaller prism is  $29.4 \text{ cm}^2$ .

Calculate the area of the cross-section of the larger prism.

[2]

- (b) The total volume of the two prisms is  $1274 \text{ cm}^3$ .

Calculate the volume of the smaller prism.

[3]

- 8 Answer the whole of this question on a sheet of graph paper.

Using a scale of 1 cm to represent 1 unit on each axis, draw a pair of axes for  $-8 \leq x \leq 8$  and  $-7 \leq y \leq 6$ .

- (a) Draw and label

(i) triangle  $K$  with vertices  $(-4, 0)$ ,  $(-2, 2)$  and  $(-2, -1)$ .

[1]

(ii) triangle  $L$  with vertices  $(-1, -7)$ ,  $(-3, -5)$  and  $(0, -5)$ .

[1]

- (b) Describe fully the single transformation that maps triangle  $K$  onto triangle  $L$ .

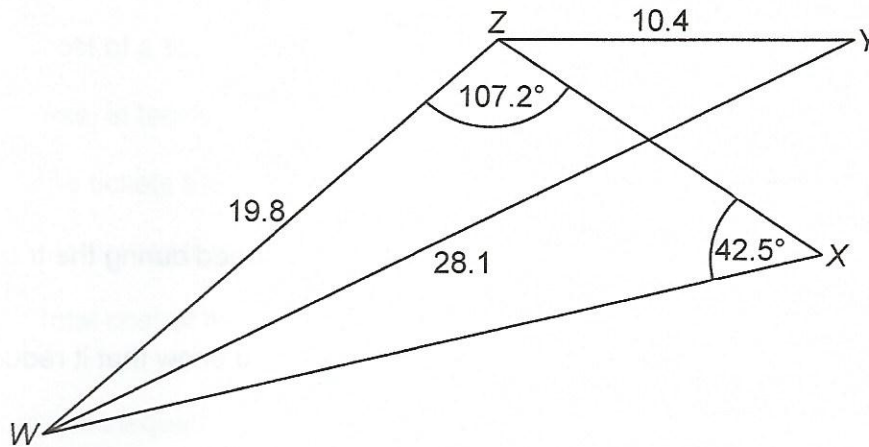
[3]

- (c) Triangle  $M$  is the image of triangle  $K$  under an enlargement of scale factor 2, centre  $(-7, 0)$ .

Draw and label triangle  $M$ .

[2]

- 9 The diagram below shows triangle  $WXZ$  and triangle  $WYZ$ .  
 $WZ = 19.8$  cm,  $ZY = 10.4$  cm and  $WY = 28.1$  cm.  
 The size of  $\hat{WXZ} = 42.5^\circ$  and the size of  $\hat{WZX} = 107.2^\circ$ .



Calculate

- (a) the size of  $\hat{WYZ}$ , [4]  
 (b)  $WX$ , [3]  
 (c) the area of triangle  $WXZ$ . [2]
- 
- 10 Answer part (b)(iii) of this question on a sheet of graph paper.

The table below shows the lengths, to the nearest cm, of 38 pencils.

Length (cm)	3 – 4	5 – 6	7 – 10	11 – 16
Number of pencils	6	9	14	9

- (a) (i) Write down the mid-point of the class 3 – 4. [1]  
 (ii) Calculate an estimate of the mean length of the pencils. [3]
- (b) (i) The boundaries of the first two classes are 2.5 – 4.5 and 4.5 – 6.5 respectively.  
 Write down the boundaries of the last two classes. [1]  
 (ii) **Without** drawing a cumulative frequency curve, calculate an estimate of the median length of the pencils. [3]  
 (iii) Draw a histogram such that the lengths of pencils in the class 5 – 6 are represented by a rectangle of width 2 cm and height 9 cm. [3]
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11 Motlhoka took  $t$  seconds to complete 800 m during a training session.

(a) Express, in terms of  $t$ , Motlhoka's speed during the training session. [1]

(b) During a competition, Motlhoka improved his training time by 15 seconds.

Express, in terms of  $t$ ,

(i) his time, [1]

(ii) his speed during the competition. [1]

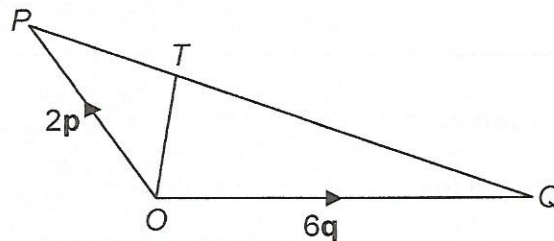
(c) During the competition, his speed was 0.6 m/s more than his speed during the training session.

Form an equation, in terms of  $t$ , to represent this information and show that it reduces to  $t^2 - 15t - 20\,000 = 0$ . [3]

(d) (i) Solve the equation  $t^2 - 15t - 20\,000 = 0$ . [5]

(ii) Calculate the time he took during the competition. [2]

12 In the diagram below  $\vec{OP} = 2\mathbf{p}$  and  $\vec{OQ} = 6\mathbf{q}$ .  $T$  is a point along  $PQ$  such that  $PT : TQ = 1 : 3$ .



Express in terms of  $\mathbf{p}$  and/or  $\mathbf{q}$

(a)  $\vec{PQ}$ , [2]

(b)  $\vec{PT}$ , [2]

(c)  $\vec{OT}$ . [2]

**13 Answer the whole of this question on a sheet of graph paper.**

A cinema sells movie tickets for children and for adults.

The number of children who bought the tickets is represented by  $x$  and the number of adults who bought the tickets is represented by  $y$ .

- (a) The cost of a ticket for a child is P15 and the cost of a ticket for an adult is P40.

Express, in terms of  $x$  and/or  $y$ , the total cost of

(i) the tickets that were bought by the children, [1]

(ii) the tickets that were bought by both the children and the adults. [1]

- (b) The total cost of the tickets that were bought by both the children and the adults is at least P240.

Form an inequality, in terms of  $x$  and  $y$ , to represent this information and show that it reduces to

$$3x + 8y \geq 48. \quad [2]$$

- (c) The total number of children and adults who bought the tickets is at most 12.

Form an inequality, in terms of  $x$  and  $y$ , to represent this information. [1]

- (d) The number of adults who bought the tickets is at least 2.

Form an inequality, in terms of  $y$ , to represent this information. [1]

- (e) Using a scale of 1 cm to represent 2 children and 1 cm to represent 1 adult, show, by shading the **unwanted** regions, the set of points satisfying the inequalities in parts (b), (c) and (d). [3]

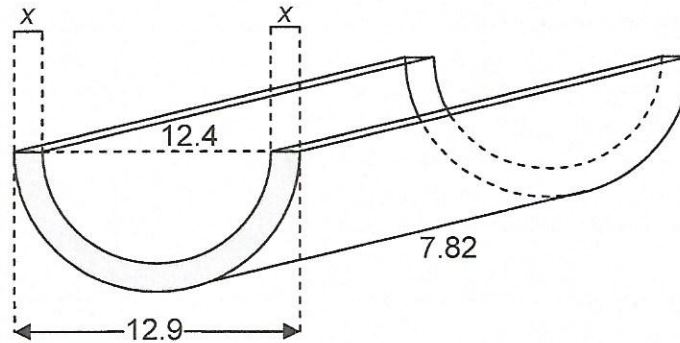
- (f) (i) The number of children who bought tickets is half that of adults.

List all the possible combinations for the number of children and adults who bought tickets. [2]

(ii) Calculate the maximum amount of money made by the cinema from the sale of tickets. [2]

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- 14 The diagram below shows a prism of length 7.82 cm with a shaded cross-section. The cross-section is bounded by two line segments each of length  $x$  cm and two semi-circular arcs. The diameter of the inner arc is 12.4 cm and the diameter of the outer arc is 12.9 cm.



- (a) Show that the area of the cross-section is  $4.97 \text{ cm}^2$ , correct to 3 significant figures. [3]
- (b) Calculate the volume of the prism. [2]
- (c) The mass of the prism is 225 g.  
Calculate the density of the prism. [2]
- (d) Calculate
- the thickness of the prism,  $x$ , [1]
  - the area of the inner curved surface, [2]
  - the total surface area of the prism. [3]
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