



MATHEMATICS

0563/03

Paper 3

October/November 2014

2 hours 30 minutes

Additional Materials: Answer paper
 Electronic calculator
 Geometrical instruments

Graph Paper (2 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 π is required, use the value from your calculator or take π as 3.142.

* 0 4 3 3 1 5 6 1 2 5 *

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

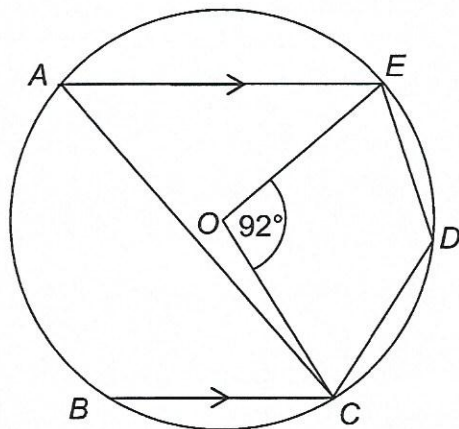
$$\text{Variance} = \frac{\sum (x - \bar{x})^2}{n}, \quad \frac{\sum f(x - \bar{x})^2}{\sum f}$$

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

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

- 1 Cattle in a district are to be vaccinated for a skin disease. The cattle are to be grouped in batches. There were 85 000 cattle vaccinated in the first batch.
- (a) In the second batch, 20% more cattle were vaccinated than in the first batch. Calculate the total number of cattle that were vaccinated in the second batch. [2]
- (b) The total number of cattle in the district is 265 000. Calculate, as a percentage, the number of cattle that were to be vaccinated in the first batch. [2]
- (c) The total number of cattle in the district is only 12.5% of the total population of cattle in the entire country. Calculate the total number of cattle in the country. [3]
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- 2 The first five terms of a sequence are 6, 6, 5, 3 and 0 .
- What is
- (a) the 6th term, [1]
- (b) an expression for the n th term, [3]
- (c) the 61st term, [2]
- (d) the value of n for which the n th term is -225 ? [3]
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- 3 The average distance of Jupiter from the Sun is 778 300 000 km.
- (a) Express the average distance of Jupiter from the Sun in metres, giving your answer in standard form. [2]
- (b) The average speed of light is 3.0×10^8 m/s. Calculate the time, in minutes, taken by light to travel from the Sun to Jupiter. [3]
- (c) The average distance of Pluto from the Sun is 5.9×10^9 km. Calculate how many more kilometres Pluto is from the Sun than Jupiter is from the Sun. [2]
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- 4 A triangular plot LMN is such that $LM = 900$ m. The size of $\hat{NLM} = 43^\circ$ and the size of $\hat{NML} = 82^\circ$.
- (a) Construct a scale diagram of the plot using 1 cm to represent 100 m. [3]
- (b) Measure and write down the actual length of MN . [2]
- (c) The plot is divided by a fence such that the fence is a bisector of side LM . Construct the locus of points that shows the path of the fence. [2]
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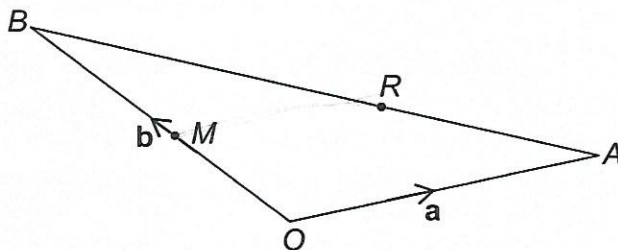
- 5 The diagram below shows a circle with centre O . The points A, B, C, D and E are on the circumference of the circle. The lines AE and BC are parallel. The size of $\hat{COE} = 92^\circ$.



State, with a reason, the size of

- (a) \hat{CAE} , [2]
- (b) \hat{CDE} , [2]
- (c) \hat{ACB} . [2]

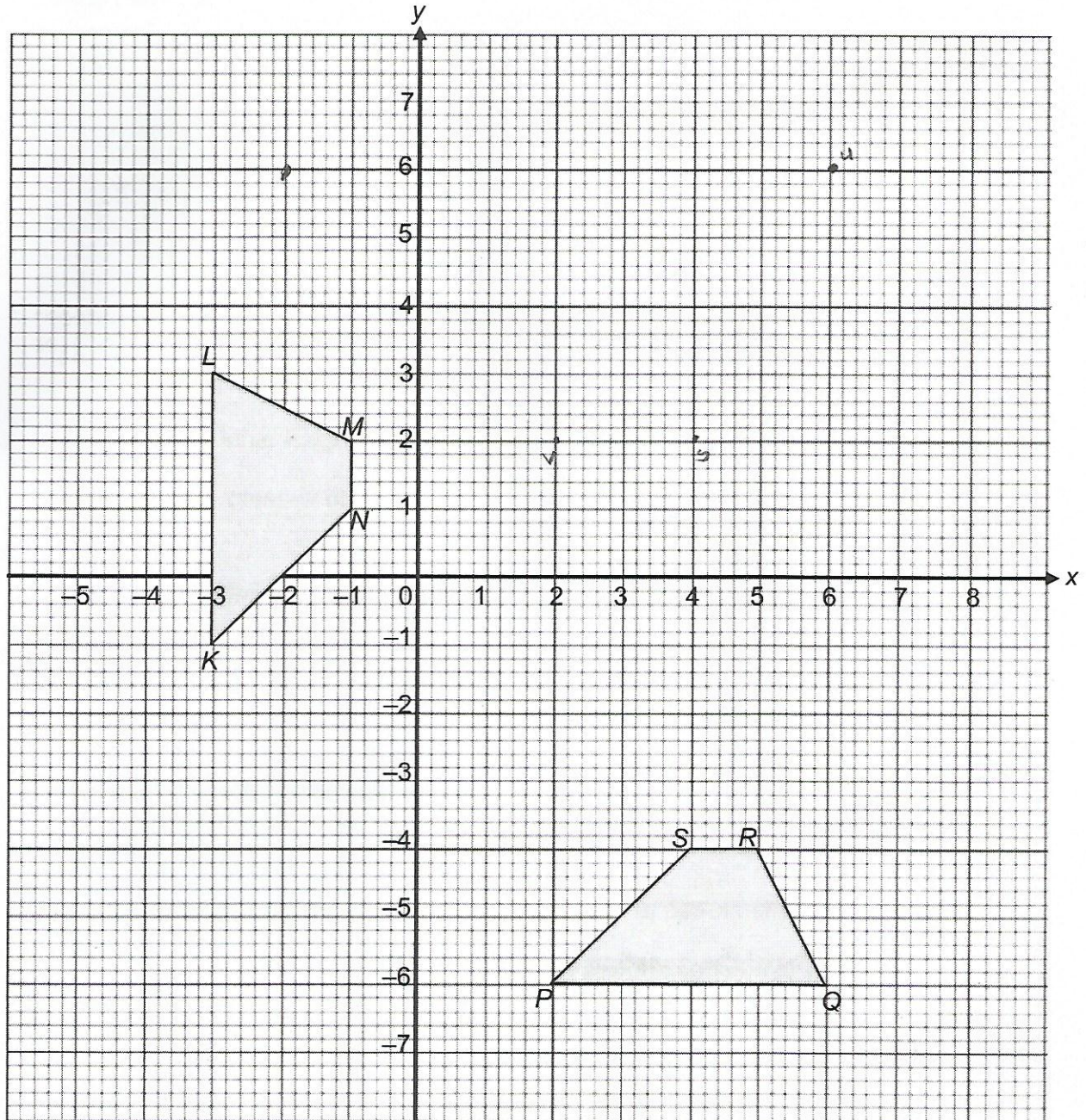
- 6 The diagram below shows the position vectors $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. M is the midpoint of OB and $AR:RB = 3:5$.



Express, in terms of \mathbf{a} and/or \mathbf{b} ,

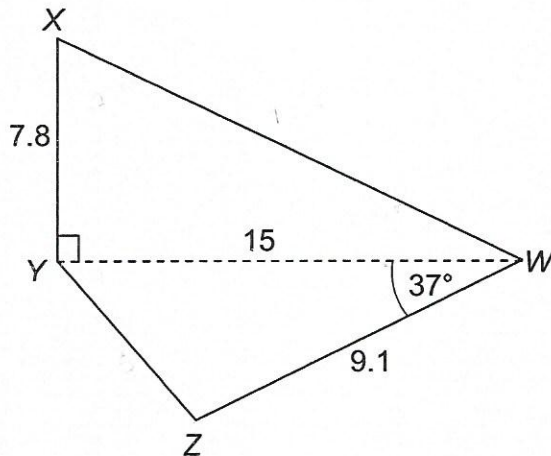
- (a) \overrightarrow{AB} , [2]
- (b) \overrightarrow{OM} , [1]
- (c) \overrightarrow{MR} . [3]

- 7 The diagram below shows trapezium $KLMN$ and trapezium $PQRS$.



- (a) Trapezium $KLMN$ is the image of trapezium $PQRS$ under a reflection.
What is the equation of the line of reflection? [2]
- (b) Trapezium $PQRS$ is mapped onto trapezium $TUVW$ by an enlargement such that the point $R(5, -4)$ is mapped onto the point $V(2, 2)$, and the point $S(4, -4)$ is mapped onto the point $W(4, 2)$.
- (i) What are the coordinates of the point U ? [1]
- (ii) Describe fully the enlargement that maps trapezium $PQRS$ onto trapezium $TUVW$. [2]

- 8 The diagram below shows the points W , X , Y and Z inside a game park. The game park has offices at W , a watering point at Y and watchtowers at X and Z . X is 7.8 km due north of Y and W is 15 km due east of Y . The size of $\widehat{YWZ} = 37^\circ$ and $WZ = 9.1$ km.



- (a) Calculate
- the distance of the watering point, Y , from the watchtower, Z , [4]
 - the size of \widehat{WYZ} , [3]
 - the bearing of Z from Y . [1]
- (b) The area enclosed by W , X , Y and Z needs to be cleared of trees and bushes for better visibility.
Calculate the area that needs to be cleared. [3]

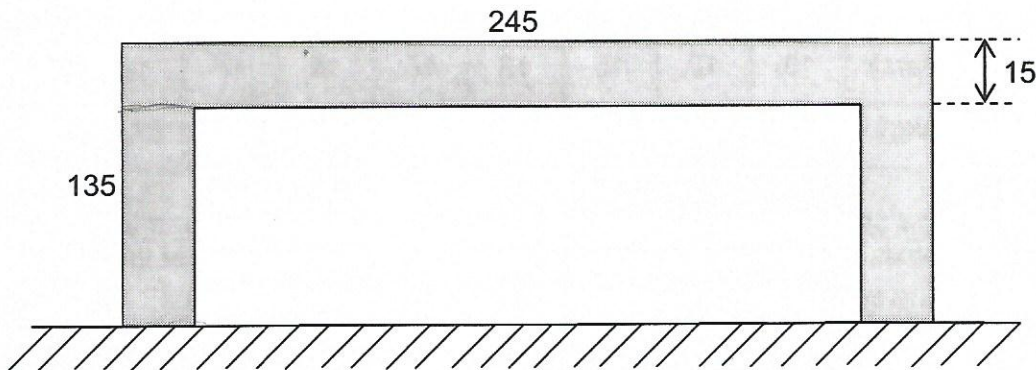
- 9 Answer part (b) of the question on a sheet of graph paper.

The table below shows the times, t hours, spent by 35 people in a library in a week.

Time (t hours)	$10 < t \leq 15$	$15 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 45$
Number of people	4	10	12	9

- (a) Without drawing a cumulative frequency curve, estimate the
- lower quartile, [2]
 - the inter-quartile range, [3]
 - 85th percentile. [2]
- (b) Draw a histogram to represent the time spent by the 35 people in a library in a week such that the class $10 < t \leq 15$ has a bar of width 2 cm and a height of 6 cm. [3]

- 10 The diagram below shows a cross-section of a concrete culvert laid on a level concrete slab. The culvert has an outer height of 135 cm, an outer width of 245 cm and a thickness of 15 cm.



- (a) Calculate the inner height of the culvert. [1]
- (b) Show that the cross-sectional area of the culvert is 7280 cm^2 , correct to 3 significant figures. [3]
- (c) The culvert has a length of 725 cm. Calculate the volume of concrete that was used to make the culvert. [2]
- (d) The culvert has a mass of 91 300 kg. Calculate the density, in g/cm^3 , of concrete. [3]
- (e) Water flows through the culvert at a level **half** the inner height of the culvert. Calculate the volume of water under the culvert at that level. [2]
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- 11 The cost of petrol is $\text{P}x$ per litre. Maano buys $\text{P}200$ worth of petrol per week.
- (a) Express, in terms of x , the number of litres of petrol Maano buys in a week. [1]
- (b) The cost of petrol was increased by $\text{P}3$ per litre. Express, in terms of x ,
- (i) the cost of petrol per litre after the increase, [1]
- (ii) the number of litres of petrol that Maano can now buy with $\text{P}200$. [1]
- (c) The number of litres of petrol that Maano can now buy is 12.5 litres less than before the increase. Form an equation, in terms of x , to represent this information and show that it reduces to
- $$x^2 + 3x - 48 = 0. \quad [3]$$
- (d) Solve the equation $x^2 + 3x - 48 = 0$, giving your answers correct to 2 decimal places. [5]
- (e) Hence, or otherwise, calculate the number of litres of petrol that Maano can buy after the increase. [2]
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12 Answer the whole of this question on a sheet of graph paper.

The table below shows the ages, A years, and the masses, m kg, of 10 boys.

Age (A years)	13	12	15	13	16	15	17	19	18	20
Mass (m kg)	42	45	44	51	52.5	56	60	62.5	65	69

- (a) Using a scale of 1 cm to represent 1 year on the x -axis and 2 cm to represent 5 kg on the y -axis, plot the scatter graph of the ages and the masses of the 10 boys. [3]
- (b) Describe the correlation between the ages and the masses of the 10 boys. [1]
- (c) Draw the line of best fit that represents the relationship between the ages and the masses of the boys. [1]
- (d) Using the line of best fit, or otherwise, estimate the mass of a boy who is 18 years of age. [1]
- (e) Two boys are chosen at random from the 10 boys.
Calculate the probability that one boy is 12 years old and the other is 13 years old. [3]

13 Katso sells sorghum and beans. A cup of sorghum costs Px and a cup of beans costs Py .

- (a) A customer buys 5 cups of sorghum and 3 cups of beans.
Write down an expression, in terms of x and/or y , for
- (i) the cost of the 5 cups of sorghum, [1]
- (ii) the total cost of 5 cups of sorghum and 3 cups of beans. [2]
- (b) The customer paid P85 for the 5 cups of sorghum and the 3 cups of beans.
Form an equation, in terms of x and y , to show this information. [1]
- (c) Another customer paid P108 for 6 cups of sorghum and 4 cups of beans.
Form an equation, in terms of x and y , to show this information. [2]
- (d) Solve simultaneously the equations in parts (b) and (c). [3]
- (e) What is the cost of 1 cup of beans? [1]

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

Betty bought scones and buns for a birthday party. The number of scones Betty bought is x and the number of buns she bought is y .

- (a) (i) The cost of 1 scone is P3.
Express, in terms of x , the cost of the scones that Betty bought. [1]
- (ii) The cost of 1 bun is P2.50.
Express, in terms of y , the cost of the buns that Betty bought. [1]
- (iii) Express, in terms of x and y , the total cost of the scones and the buns Betty bought. [1]
- (iv) Betty used at most P180 to buy the scones and the buns.
Write an inequality, in terms of x and y , and show that it reduces to
$$6x + 5y \leq 360.$$
 [2]
- (b) The number of buns that Betty bought is at least 10 more than the number of scones.
Write an inequality, in terms of x and y , to show this information. [1]
- (c) Betty bought at least 10 scones.
Write another inequality, in terms of x and/or y , to represent this information. [1]
- (d) Using a scale of 2 cm to represent 10 scones and 2 cm to represent 20 buns, show, by shading the **unwanted** regions, the set of points satisfying the three inequalities in parts **(a)(iii)**, **(b)** and **(c)**. [3]
- (e) The scones and the buns are bought in small packages which contain either 10 scones or 10 buns.
- (i) List all the possible ways in which Betty can buy the scones and the buns. [2]
- (ii) Calculate the amount of money Betty needs to use to buy 5 times as many buns as scones. [2]
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