MATHEMATICS
Paper 1

4016/01
October/November 2015
2 hours

Answer **all** the questions.

1 Solve $\frac{x}{5} + 14 = 8$.

Answer $x =$ ..... [1]

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2 Frank bought an antique vase for $345.
One year later he sold it for a profit of 180% of the cost price.

Calculate the selling price.

Answer $ ..... [2]

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3 Alec has written down five numbers.
The mean of these numbers is 7, the median is 5 and the mode is 4.
The largest number is three times the smallest number.

Find the five numbers.

Answer ....., ..., ..., ..., ... [2]

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4 A field has an area of $1400\,m^2$.
An average of 60 dandelion plants grow on each square metre.
Each plant has an average of 20 flowers.
Joel estimates that these plants will produce 2×10^8 seeds in total.

Calculate an estimate of the average number of seeds produced by each flower.

Answer ..... [2]

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5 Simplify $\frac{4x}{3} - \frac{3(2-5x)}{4}$.

Answer ..... [2]

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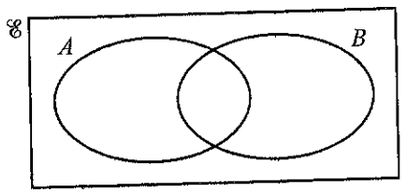
6 $\mathscr{E} = \{\text{integers } x : 1 \leqslant x \leqslant 8\}$
$A = \{\text{factors of } 6\}$
$B = \{\text{prime numbers}\}$

(a) List the elements in $A' \cap B'$.

Answer (*a*) ..... [1]

(b) On the Venn diagram, shade the region which represents $A' \cap B'$.



[1]

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7 Factorise fully $4ax - 3ay - 8bx + 6by$.

Answer ..... [2]

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8 A is the point $(-1, 4)$ and $\overrightarrow{BA} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$.

(a) Find the coordinates of point B.

Answer (*a*) B (..... , ...) [1]

(b) Calculate $|\overrightarrow{AB}|$.

Answer (*b*) ..... [1]

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9 Simon weighed six apples.

The mean mass of the apples was 137 grams.
The standard deviation of the masses of the apples was 5.48 grams.

The scales used by Simon were found to be inaccurate.
The correct mass of each apple was 25 grams more than Simon recorded.

Write down the correct values for the mean and standard deviation (SD).

Answer Mean = ...

SD = ... [2]

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10 Ravi invests \$28 700 in an account.
The balance, \$$A$, of the account after t years is given by the formula $A = 28\,700 \times 1.033^t$.

(a) Calculate A when $t = 4$.
Give your answer correct to the nearest dollar.

Answer (*a*) \$ ..... [1]

(b) Find the percentage increase in the balance over the 4 years.

Answer (*b*) ..... % [2]

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11 Teresa is drawing a triangle.
The second angle is 18° smaller than the first angle.
The third angle is four times the size of the second angle.

Form an equation and solve it to find the angles of the triangle.

Answer ....., ..., ... [3]

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12 **(a)** Wong makes a fruit drink.
He uses apple juice, peach juice and lemonade in the ratio 5 : 2 : 8 respectively.
He uses 2.4 litres of lemonade.

(i) How much apple juice does he use?

Answer (*a*)(i) ..... litres [1]

(ii) How much fruit drink does he make altogether?

Answer (*a*)(ii) ..... litres [1]

(b) Min makes a fruit drink using orange juice, lemonade and pineapple juice.
The ratio orange juice : lemonade is 2 : 5.
The ratio lemonade : pineapple juice is 3 : 4.

Find the ratio orange juice : lemonade : pineapple juice.

Answer (*b*) ..... : ..... : ..... [1]

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13 Gina can paint 7 fence panels in 5 hours.
Lim can paint 6 fence panels in 4 hours.

Gina and Lim work together to paint a total of 17 panels.

If they continue to paint at the same rate, how long will it take them to paint the 17 panels?
Give your answer in hours and minutes, to the nearest minute.

Answer ..... hours ..... minutes [3]

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14 **(a)** Express 450 as the product of its prime factors.

Answer (*a*) ..... [1]

(b) Find two numbers, both smaller than 100, that have a lowest common multiple of 450 and a highest common factor of 15.

Answer (*b*) ..... [2]

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15 **(a)** Solve the inequalities $-10 \leqslant 7 - 2x < 1$.

Answer (*a*) ..... [2]

(b) Write down all the integers that satisfy $-10 \leqslant 7 - 2x < 1$.

Answer (*b*) ..... [1]

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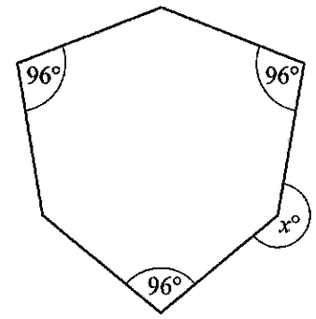
16 The diagram shows a hexagon.
All of the sides have the same length.
Three interior angles are each 96°.
The remaining three interior angles are equal.

Find x.



Answer $x =$ ..... [3]

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17 Two bottles of water are geometrically similar.
The larger bottle holds 2 litres and the smaller bottle holds 1.25 litres.
The height of the larger bottle is 33.5 cm.

(a) Calculate the height of the smaller bottle.

Answer (*a*) ..... cm [2]

(b) The ratio surface area of larger bottle : surface area of smaller bottle can be written in the form $k : 1$.

Find the value of k.
Give your answer to 2 decimal places.

Answer (*b*) $k =$ ..... [2]

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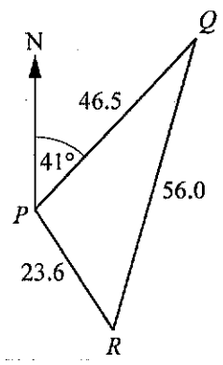
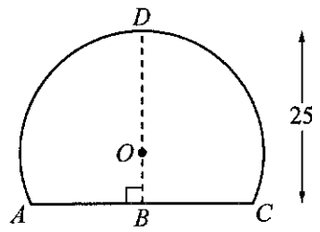
18 The diagram shows the positions of three towns P, Q and R.
PQ is 46.5 km, PR is 23.6 km and QR is 56.0 km.
The bearing of Q from P is 041°.



Calculate the bearing of R from P.

Answer ..... [4]

19 $ABCD$ is a major segment of a circle, centre O and radius 17 cm.
$BD = 25$ cm.
Angle $ABD = 90°$.



Calculate the area of the segment.

Answer ..... cm^2 [5]

20 P is the point (0, 3), Q is the point (4, 11) and R is the point (a, 3).

(a) The product (gradient of PQ) × (gradient of QR) = –1 .

Use this information to show that $a = 20$.

Answer (a)

[2]

(b) The line PQ is perpendicular to the line QR.

Use vectors to find the coordinates of the point S, so that $PQRS$ is a rectangle.

Answer (b) (..... , ...) [1]

(c) Calculate the area of the rectangle $PQRS$.

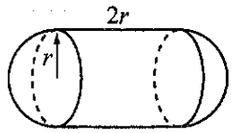
Answer (c) ..... $unit^2$ [2]

21 **(a)** The surface area of a solid is given by $A = \pi p(2p + q)$.

Make q the subject of the formula.

Answer (*a*) ..... [2]

(b) Another solid is made from a cylinder and two hemispheres.
The cylinder has radius r and length $2r$
and the hemispheres have radius r.



The total surface area of the solid is twice the total surface area of a cone with radius r and slant height l.

Find l in terms of r.

Answer (*b*) l = ... [3]

22 In supermarket A, water costs \$1.50 per litre, milk costs \$2.40 per litre and cola costs \$1.40 per litre.
In supermarket B, water costs \$0.20 more per litre, milk costs \$0.40 less per litre and cola costs \$0.10 less per litre.

This information can be represented by the matrix $\mathbf{Q} = \begin{matrix} \\ \text{W} \\ \text{M} \\ \text{C} \end{matrix} \begin{matrix} \begin{matrix} \text{A} & \text{B} \end{matrix} \\ \begin{pmatrix} 1.5 & 0.2 \\ 2.4 & -0.4 \\ 1.4 & -0.1 \end{pmatrix} \end{matrix}$.

(a) Natalie and Hadi go shopping.
Natalie buys 4 litres of water, 2 litres of milk and 3 litres of cola.
Hadi buys 3 litres of water and 4 litres of cola.

Represent their purchases in a 2×3 matrix $\mathbf{P}$.

Answer (*a*) $\mathbf{P} = \begin{pmatrix} & & \\ & & \end{pmatrix}$ [1]

(b) Evaluate the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer (*b*) $\mathbf{R}$ = [2]

(c) How much money would Hadi save by shopping in supermarket A?

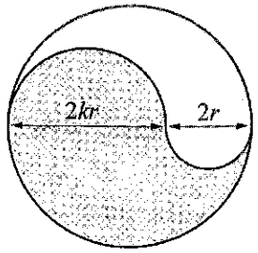
Answer (*c*) \$ ..... [1]

(d) Natalie shops in supermarket B.
She has a shopping voucher giving a discount of 10%.

How much does she pay altogether for her items?

Answer (*d*) \$ ..... [2]

23 This design is drawn using a large circle and semicircles.
The diameters, in centimetres, of two of the semicircles are shown.



(a) Show that the total area, A, of the large circle is given by the formula $A = \pi r^2(k+1)^2$.

Answer (*a*)

[2]

(b) Find, in terms of π and r, the difference in area between the shaded section and the unshaded section when $k = 2$.

Answer (*b*) ..... cm^2 [4]

24 A bag contains 10 marbles, n of which are red and the rest are yellow.
A marble is chosen at random and not replaced.

(a) Write down, in terms of n, the probability that the marble is yellow.

Answer (*a*) ..... [1]

A second marble is chosen at random.

(b) Find, in terms of n, the probability that both marbles are yellow.

Answer (*b*) ..... [1]

(c) **(i)** The probability that both marbles are yellow is $\frac{1}{15}$.

Show that $n^2 - 19n + 84 = 0$.

Answer (*c*)(i)

[2]

(ii) Solve the equation $n^2 - 19n + 84 = 0$ to find the number of yellow marbles in the bag.

Answer (*c*)(ii) ..... [3]