CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

MATHEMATICS (US) **0444/23**

Paper 2 (Extended) **October/November 2016**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
CALCULATORS MUST NOT BE USED IN THIS PAPER.
All answers should be given in their simplest form.
If work is needed for any question it must be shown in the space provided.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 70.

Formula List

For the equation $\qquad\qquad ax^2 + bx + c = 0 \qquad\qquad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Lateral surface area, A, of cylinder of radius r, height h. $\qquad A = 2\pi rh$
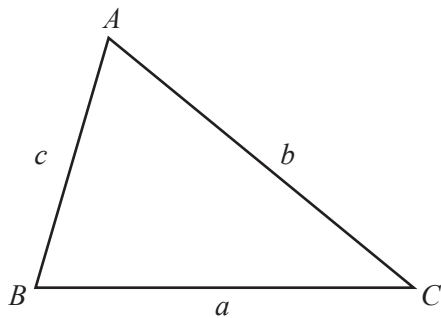
Lateral surface area, A, of cone of radius r, sloping edge l. $\qquad A = \pi rl$

Surface area, A, of sphere of radius r. $\qquad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\qquad V = \dfrac{1}{3}Ah$

Volume, V, of cone of radius r, height h. $\qquad V = \dfrac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\qquad V = \dfrac{4}{3}\pi r^3$

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

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

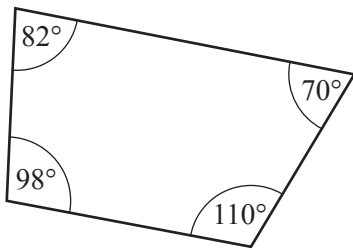$$\text{Area} = \dfrac{1}{2}bc \sin A$$
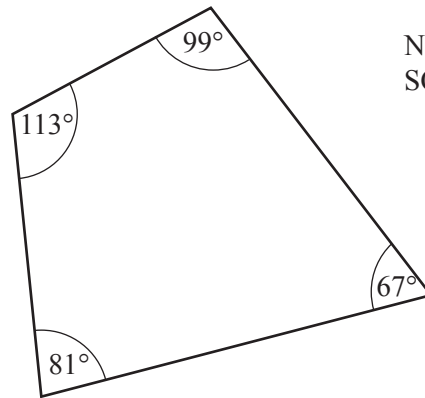
1 $V = 4p^2$

Find V when $p = 3$.

$V =$ ....[1]

2   Simplify.

$n^2 \times n^5$

....[1]

3
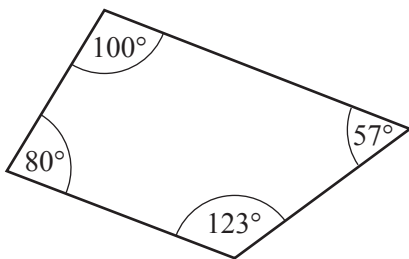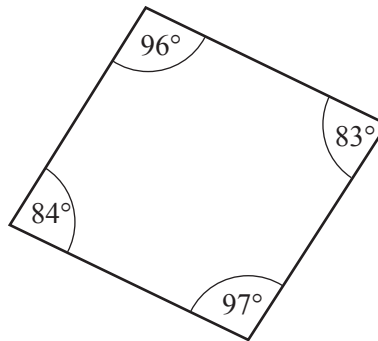
The diagram shows four quadrilaterals A, B, C and D.

Which one of these could be a cyclic quadrilateral?

....[1]

4 Write in scientific notation.

(a) 2 470 000

.... [1]

(b) 0.0079

.... [1]

5 Work out $\dfrac{3}{5}+\dfrac{1}{6}$.

Give your answer as a fraction in its simplest form.

.... [2]

6 James is an animal doctor.
The table shows some information about the cats he saw in one week.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Number of cats seen	2	4	1	3	2
Mean mass of a cat (kg)	1.9	0.9	2.1	1.8	2

One of the cats James saw had a mass of 4 kg.

On which day did he see this cat?

.... [2]

7 Write these in order of size, smallest first.

$$\left(\frac{1}{2}\right)^2 \qquad 0.22 \qquad \sqrt{0.09} \qquad 0.4^2$$

.... < .... < .... < ....[2]
smallest

8 (a) $\sqrt{3} = 3^m$

Write down the value of *m*.

m = ... [1]

(b) $8 = 4^n$

Find the value of *n*.

n = ... [1]

9 Ryan cycles at an average speed of 20 km/h for 15 minutes.

Work out the distance he travels.

.... km [2]

10 Simplify $\sqrt{27} + \sqrt{75}$.

.... [2]

11 Ahmed paid $20 000 for a car.
His car decreased in value by 40% at the end of the first year.
The value at the end of the second year was 20% less than the value at the end of the first year.

Calculate the value of Ahmed's car after 2 years.

$ .... [2]

12
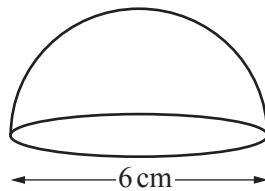
NOT TO
SCALE

The diagram shows a hemisphere with diameter 6 cm.

The volume of this hemisphere is $k\pi \, \text{cm}^3$.
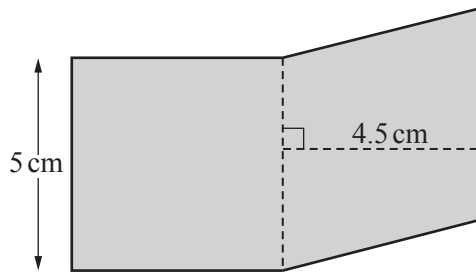
Find the value of k.

$k = $ .... [2]

13 $f(x) = 4\sin(3x)$

Write down the period and amplitude of $f(x)$.

Period = ... [1]

Amplitude = ... [1]

14   The shaded shape is made by joining a square and a rhombus.

NOT TO
SCALE

Work out

(a) the perimeter of the shaded shape,

.... cm [1]

(b) the area of the shaded shape.

.... cm² [2]

       [Turn over

15 (a)
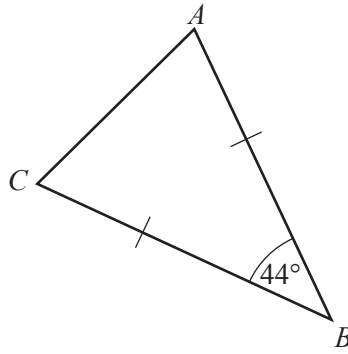
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Triangle *ABC* is an isosceles triangle with *AB* = *CB*.
Angle *ABC* = 44°.

Find angle *ACB*.

Angle *ACB* = ... [1]

(b) A regular polygon has an exterior angle of 40°.

Work out the number of sides of this polygon.

.... [2]

16 *d* varies inversely as $(w + 1)^2$.
d = 2 when *w* = 4.

Find *d* when *w* = 9.

d = ... [3]

17 *A* is the point (8, 3) and *B* is the point (12, 1).

Find the equation of the line, perpendicular to the line *AB*, which passes through the point (0, 0).

.... [3]

18 $f(x) = 3x - 1$ $g(x) = 1 - x$ $h(x) = 2^x$

Find

(a) f(– 5),

.... [1]

(b) h(0),

.... [1]

(c) g(f(x)),

.... [2]

(d) $g^{-1}(x)$.

$g^{-1}(x) =$ .... [1]

 [Turn over

19 The curve $y = x^3 + 2x^2 - 4x$ is shown on the grid.
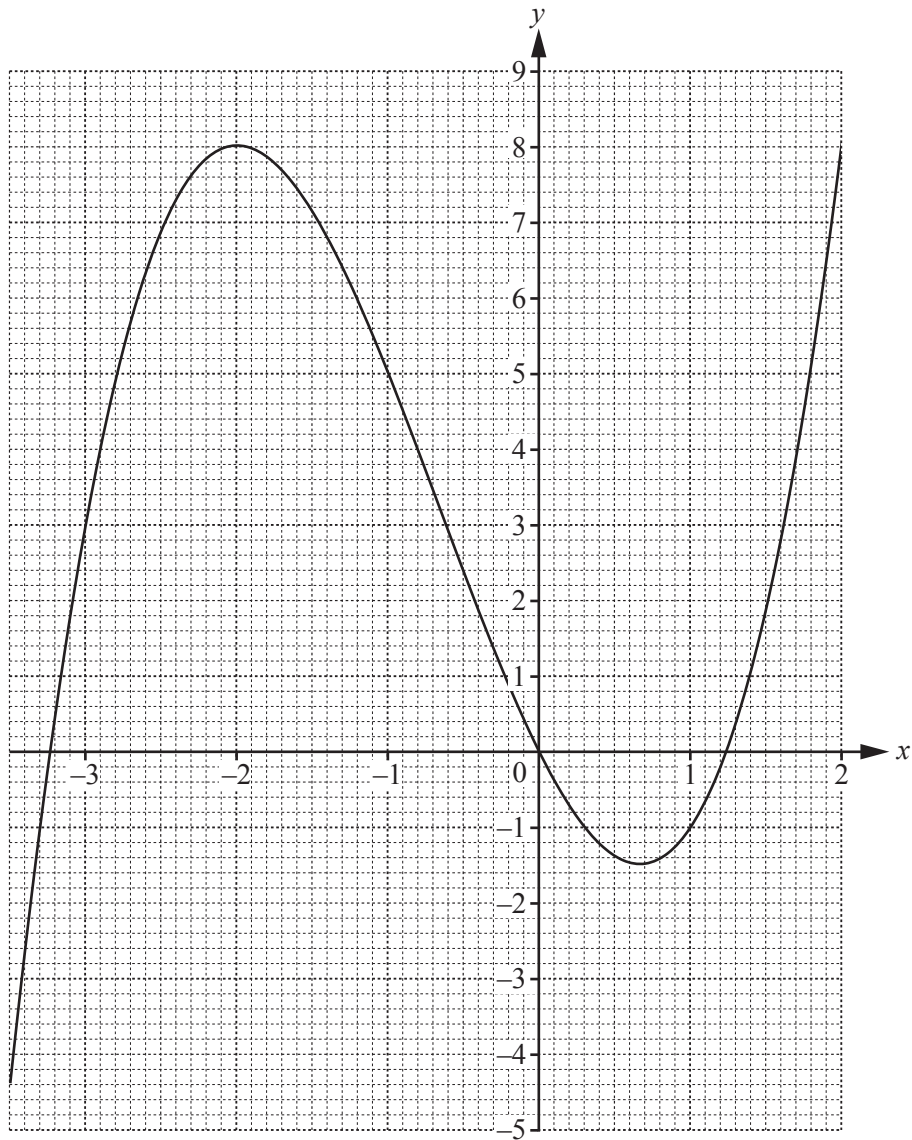
(a) By drawing a suitable tangent, find an estimate of the slope of the curve when $x = 1$.

.... [3]

(b) A point D lies on the curve.
The x co-ordinate of D is negative.
The slope of the tangent at D is 0.
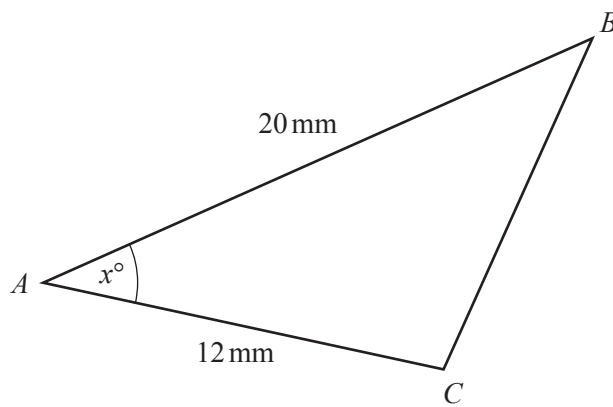
Write down the co-ordinates of D.

(.................... , ...) [1]

20 Solve.

   (a) $3w^2 = \dfrac{4}{3}$

.... [2]

   (b) $y^{\frac{2}{5}} = 4$

.... [2]

21

The area of triangle *ABC* is $60\,\text{mm}^2$.

Work out the value of *x*.

$x =$ .... [3]

22 The table shows some information about the mass, *m* grams, of 200 bananas.

Mass (*m* grams)	$90 < m \leqslant 110$	$110 < m \leqslant 120$	$120 < m \leqslant 125$	$125 < m \leqslant 140$
Frequency	40	70	60	30
Height of column in histogram (cm)			6	

Complete the table.

[4]

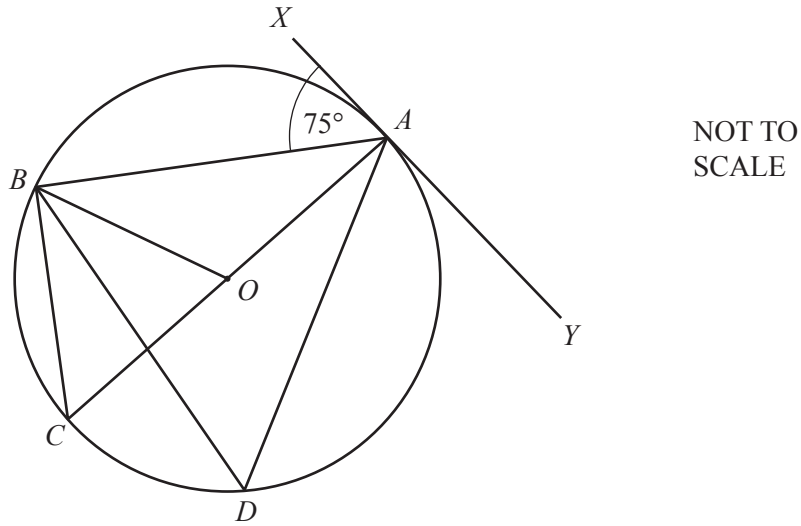**23** Simplify. $\dfrac{42np - 7n}{12pt - 2t + 18mp - 3m}$

.... [4]

24
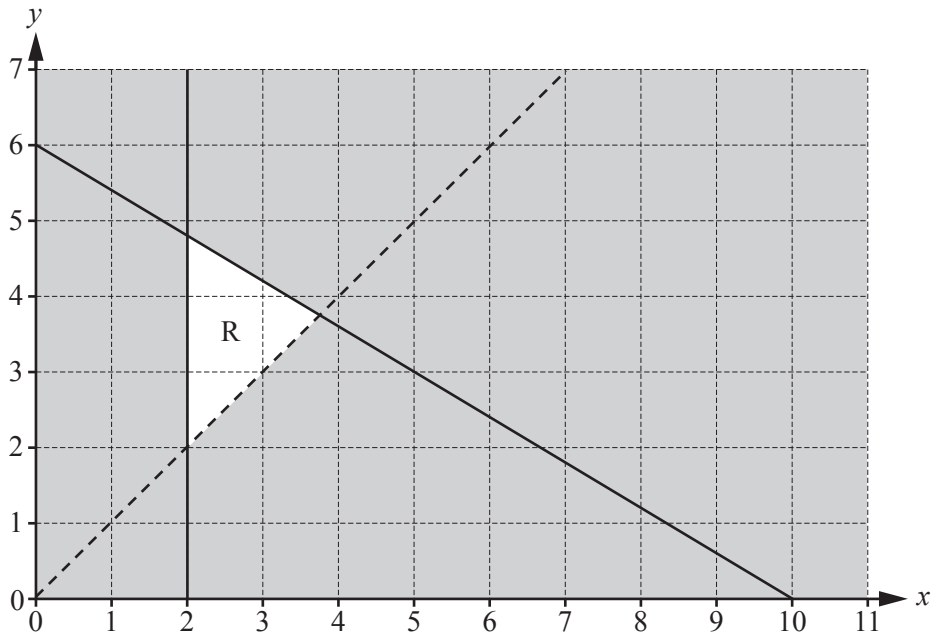
Find the three inequalities that define the unshaded region, R.

....

....

.... [5]

25 (a)

NOT TO
SCALE

A, *B*, *C* and *D* lie on the circle, center *O*.
XAY is a tangent to the circle at *A*.
Angle *XAB* = 75°.

Find

(i) angle *ACB*,

Angle *ACB* =... [2]

(ii) angle *AOB*,

Angle *AOB* =... [1]

(iii) angle *ADB*.

Angle *ADB* =... [1]

(b)
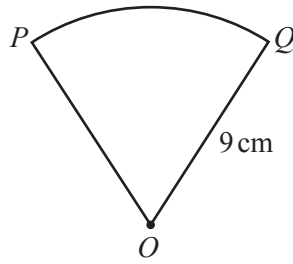
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PQ is an arc of a circle, center *O* and radius 9 cm.
The length of the arc *PQ* = 2π cm.

Work out angle *POQ*.

Angle *POQ* =... [2]

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