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MATHEMATICS (US)

0444/21

Paper 2 (Extended)

May/June 2022

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, center number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.
- You may use tracing paper.
- You must show all necessary work clearly.
- All answers should be given in their simplest form.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in parentheses [].

This document has **12** pages.

Formula List

For the equation

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Lateral surface area, A , of cylinder of radius r , height h .

$$A = 2\pi rh$$

Lateral surface area, A , of cone of radius r , sloping edge l .

$$A = \pi rl$$

Surface area, A , of sphere of radius r :

$$A = 4\pi r^2$$

Volume, V , of pyramid, base area A , height h .

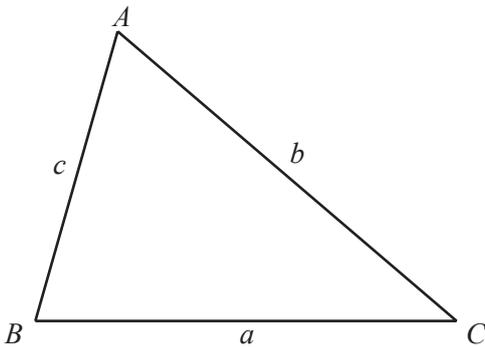
$$V = \frac{1}{3}Ah$$

Volume, V , of cone of radius r , height h .

$$V = \frac{1}{3}\pi r^2 h$$

Volume, V , of sphere of radius r .

$$V = \frac{4}{3}\pi r^3$$



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

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

$$\text{Area} = \frac{1}{2}bc \sin A$$

1 Write down a prime number between 30 and 40.

..... [1]

2 Work out $3^4 - 2^3$.

..... [1]

3 Jason starts a run at 10.05 am and finishes at 1.02 pm.

Work out the time Jason takes to complete the run.

..... h min [1]

4 Kirsty changes \$384 into pounds (£) when $\text{£}1 = \$1.20$.

Work out the amount Kirsty receives.

£ [2]

5 Write 180 as a product of its prime factors.

..... [2]

6 Work out $\frac{3}{7} - \frac{2}{21}$.

Give your answer as a fraction in its simplest form.

..... [2]

7 $s = \frac{1}{2}at^2$

(a) Work out the value of s when $a = 0.9$ and $t = 4$.

$s =$ [1]

(b) Solve for t .

$t =$ [2]

8 Factor completely.

$$14xy - 7y^2$$

..... [2]

9 22, 17, 12, 7, 2, ...

(a) Find the next term of the sequence.

..... [1]

(b) Find the n th term of the sequence.

..... [2]

10 The interior angles of a pentagon are in the ratio $4 : 5 : 5 : 7 : 9$.

Find the size of the largest angle.

..... [3]

11 Work out $2 \times 10^{100} - 2 \times 10^{98}$, giving your answer in scientific notation.

..... [2]

- 12 A train passes through a station at a speed of 72 km/h.
The length of the station is 100 m.
The train takes 7 seconds to completely pass through the station.

Work out the length of the train.

..... m [3]

- 13 Simplify $\sqrt{250} + \sqrt{810}$.

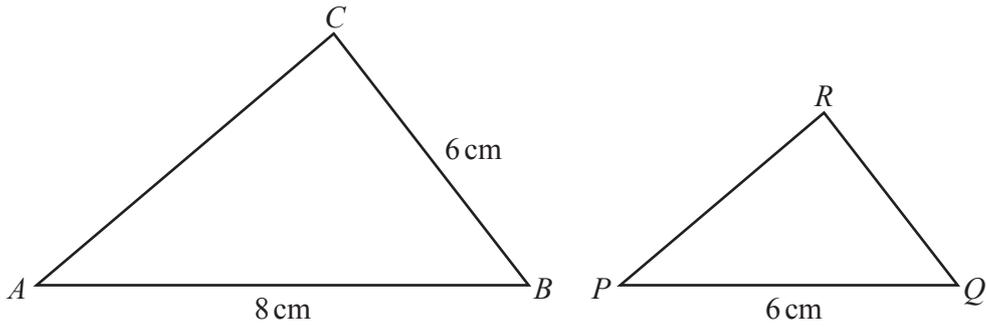
..... [2]

- 14 $4^x = \frac{1}{64}$

Find the value of x .

$x =$ [1]

15



NOT TO SCALE

Triangle ABC is mathematically similar to triangle PQR .

(a) Work out QR .

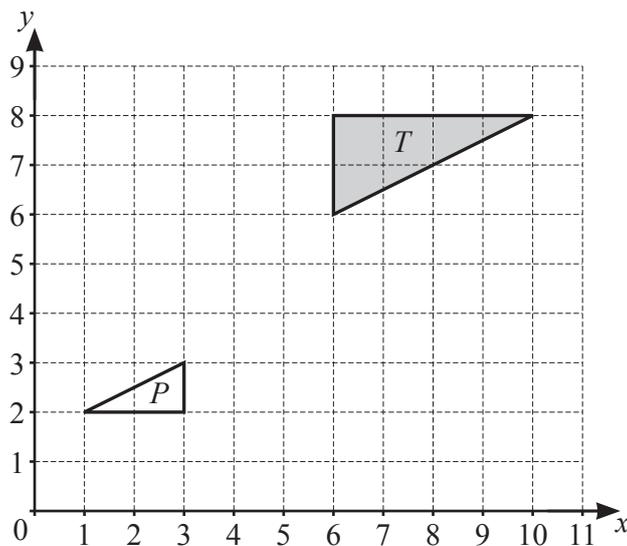
$QR = \dots\dots\dots$ cm [2]

(b) The two triangles are the cross-sections of two mathematically similar prisms. The surface area of the larger prism is 640 cm^2 .

Work out the surface area of the smaller prism.

$\dots\dots\dots$ cm^2 [2]

16



Describe fully the **single** transformation that maps triangle T onto triangle P .

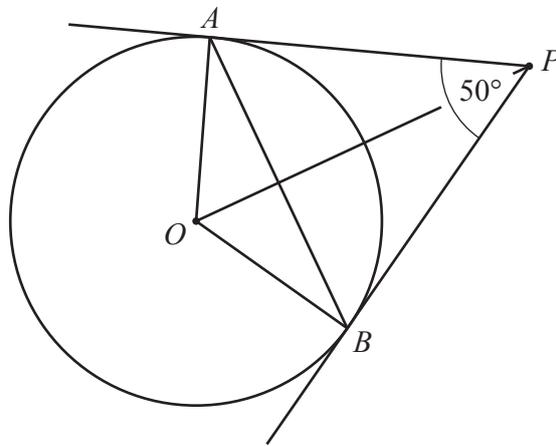
.....

[3]

17 Find the radius of a sphere of volume $\frac{9}{2}\pi \text{ cm}^3$.

..... cm [3]

18



NOT TO SCALE

The diagram shows a circle, center O .
 PA and PB are tangents to the circle at the points A and B .
 Angle $APB = 50^\circ$.

(a) Write down the mathematical name for triangle PAB .

..... [1]

(b) Work out.

(i) Angle PAB

Angle $PAB =$ [1]

(ii) Angle OAB

Angle $OAB =$ [1]

(c) Write down a pair of triangles that are congruent.

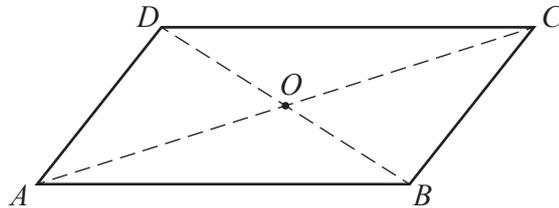
..... and [1]

- 19 (a) A vertex of a square-based pyramid is vertically above the center of the base.

Write down the number of planes of symmetry for this pyramid.

..... [1]

- (b)



NOT TO SCALE

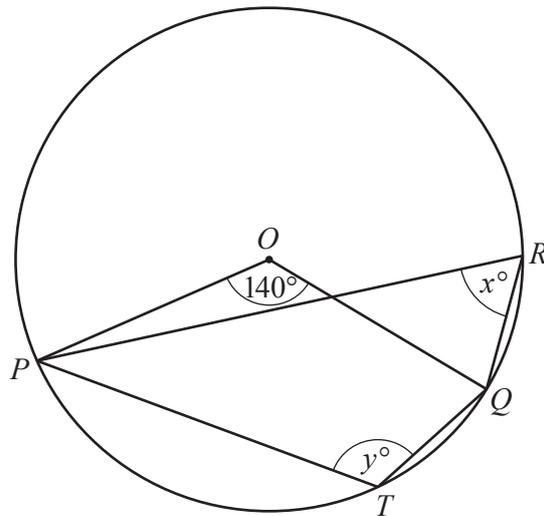
$ABCD$ is a parallelogram and its diagonals meet at O .

Describe fully the **single** transformation that maps the parallelogram onto itself but with the points A, B, C and D in different positions.

.....

..... [2]

20



NOT TO SCALE

P, T, Q and R are points on a circle, center O .
Angle $POQ = 140^\circ$.

- (a) Work out the value of x and give a geometrical reason for your answer.

$x =$ because

..... [2]

- (b) Work out the value of y .

$y =$ [1]

21 Solve.

$$\frac{t}{3t-2} = \frac{3}{5}$$

$$t = \dots\dots\dots [3]$$

22 Solve.

$$2\sqrt{x} + 1 = 7 - \sqrt{x}$$

$$x = \dots\dots\dots [2]$$

23 Factor completely.

$$1 - q - a + aq$$

$$\dots\dots\dots [2]$$

24 Simplify fully $(216y^{216})^{\frac{2}{3}}$.

..... [2]

25 $x^2 + 8x + 10 = (x + p)^2 + q$

(a) Find the value of p and the value of q .

$p =$

$q =$ [2]

(b) Solve.

$$x^2 + 8x + 10 = 30$$

$x =$ or $x =$ [2]

26 w varies directly as the square root of y .

y varies inversely as x .

When $x = 4$, $y = 16$ and $w = 8$.

Find w in terms of x .

$w =$ [3]

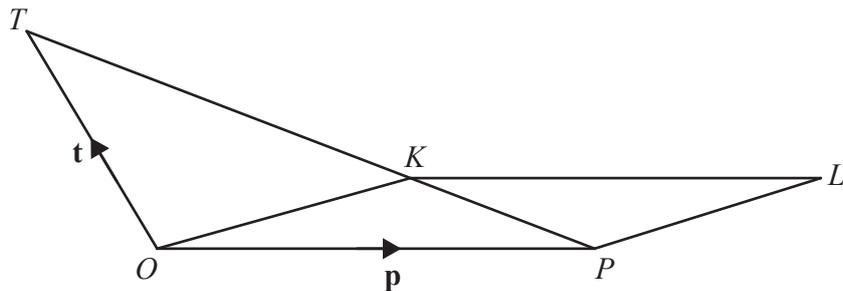
Questions 27 and 28 are printed on the next page.

27 Simplify.

$$\frac{x-3}{x^2-2x-3}$$

..... [2]

28



NOT TO SCALE

The diagram shows a triangle OPT and a parallelogram $OPLK$.
 The position vector of P is \mathbf{p} and the position vector of T is \mathbf{t} .
 K is on PT so that $PK : KT = 1 : 2$.

Find in terms of \mathbf{p} and \mathbf{t} ,

(a) \overrightarrow{PK} ,

$\overrightarrow{PK} = \dots\dots\dots$ [2]

(b) the position vector of L , giving your answer in its simplest form.

..... [2]

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