



BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2023
SECONDARY FOUR NORMAL (ACADEMIC)

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

MATHEMATICS (SYLLABUS A)

Paper 2

Setter:

Mr Lawrence Koh

4045/02

4 August 2023

2 hours

Candidates answer on the Question Paper

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number 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.

Section A

Answer **all** questions.

Section B

Answer **one** question.

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

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 60.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

For Examiner's Use

This document consists of **15** printed pages and **0** blank pages.

[Turn over

Mathematical Formulae*Compound interest*

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

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

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Section A (52 marks)

Answer **all** the questions in this section.

- 1 When written as a product of its prime numbers, $504 = 2^3 \times 3^2 \times 7$.
(a) Write 540 as a product of its prime numbers.

Answer [1]

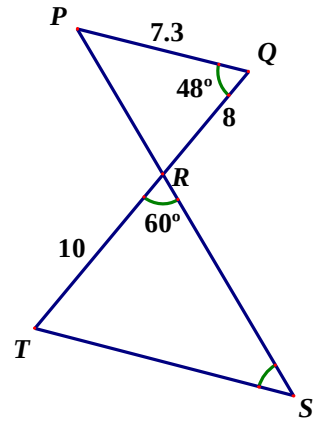
- (b) Hence, find the greatest integer that will divide both 504 and 540 exactly.

Answer [1]

- 2 A bank pays investors 3.2% per annum compound interest, compounded half-yearly.
Ahmad invested \$10 000 for a period of 3 years.
Calculate the interest earned after 3 years.
Leave your answer correct to the nearest dollar.

Answer \$..... [3]

- 3 In the diagram, $\triangle PQR$ is similar to $\triangle STR$.



Find

- (a) angle RST ,

Answer [1]

- (b) the length of ST .

Answer $ST = \dots\dots\dots$ cm [2]

- 4 Four tennis balls are packed tightly in a cylindrical tube. The radius of a tennis ball is r cm. Show that the empty space in the tube is one third of the total volume of the tube.

Answer



[3]

- 5 (a) Solve $2x^2 - 4x - 7 = 0$ using the quadratic formula.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [3]

- (b) Solve these simultaneous equations.

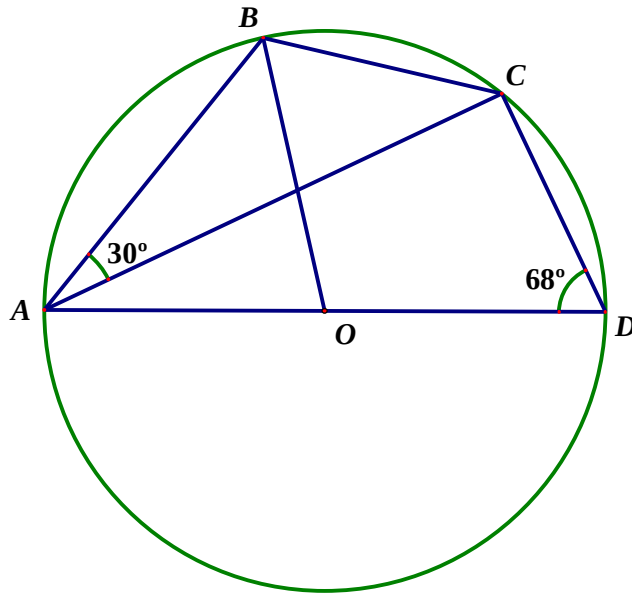
$$4x + y = 6$$

$$x - 2y + 3 = 0$$

Answer $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

- 6 The points A , B , C and D lie on the circumference of a circle centre O . AOD is the diameter of the circle. $\angle BAC = 30^\circ$ and $\angle CDA = 68^\circ$.



- (a) Explain why angle ACD is 90° .

Answer [1]

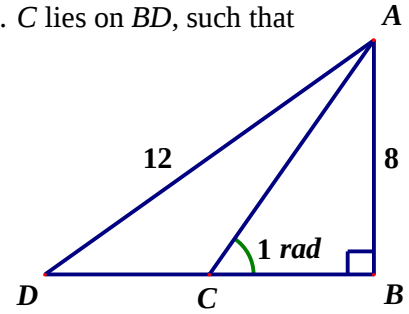
- (b) Find
(i) angle ABC ,

Answer [1]

- (ii) angle OBA .

Answer [2]

- 7 In the right-angled triangle ABD , $AB = 8$ cm and $AD = 12$ cm. C lies on BD , such that $\angle ACB = 1$ rad.



Find

- (a) $\angle ADB$ in radians,

Answer [2]

- (b) the length of BC ,

Answer cm [2]

- (c) the area of triangle ACD .

Answer cm^2 [3]

8 (a) Expand and simplify $(3a - b)^2 + b(2a - b)$.

Answer [3]

(b) Factorise the following expressions.

(i) $12 - 3x^4$

Answer [2]

(ii) $4y - 10 + 6yz - 15z$

Answer [2]

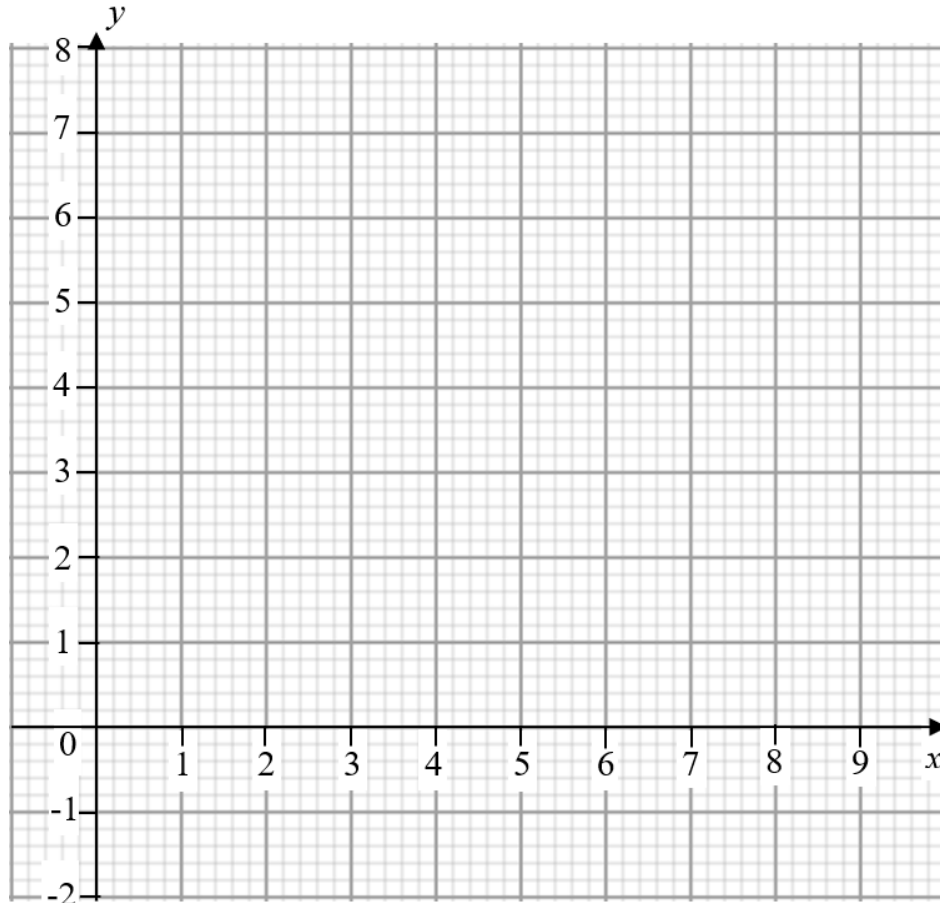
- 9 (a) Complete the table of values for $y = \frac{x^2}{9} + \frac{12}{x} - 6$.

Give your answers correct to one decimal place.

x	1	1.5	2	2.5	3	5	7	9
y	6.1	2.3	0.4	-0.5	-1	-0.8		4.3

[1]

- (b) Draw the graph of $y = \frac{x^2}{9} + \frac{12}{x} - 6$ for $1 \leq x \leq 9$.



[3]

- (c) Write down the coordinates of the minimum point of the curve.

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

- (d) By drawing a suitable tangent, find the gradient of the curve when $x = 7$.

Answer [2]

- (e) Use your graph to solve the equation $\frac{x^2}{9} + \frac{12}{x} = 7$.

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

- 10 The table below shows the walking speed of people across different age groups.

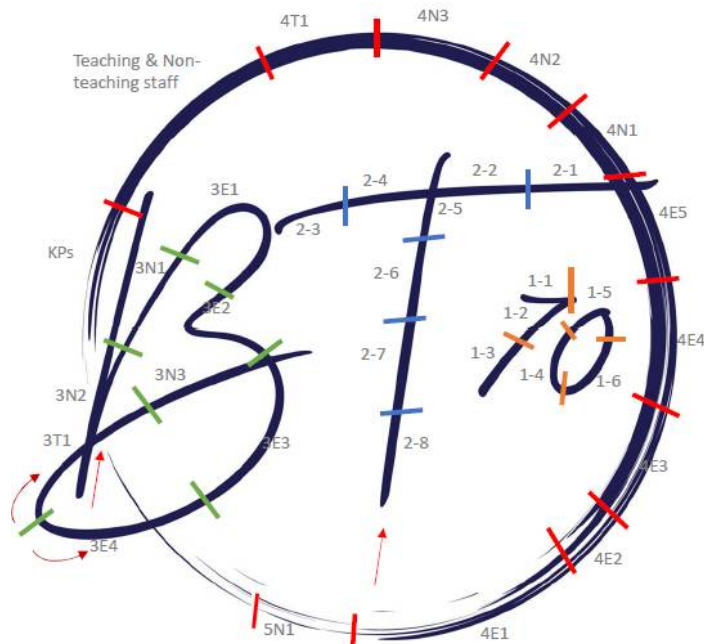
Age	Kilometers per hour (km/h)	Miles per hour (mph)
<30	4.82 km/h	3 mph
30–39	4.54 km/h	2.8 mph
40–49	4.54 km/h	2.8 mph
50–59	4.43 km/h	2.75 mph
>60	4.34 km/h	2.7 mph

<https://www.medicalnewstoday.com/articles/average-walking-speed#average-speed-by-age>

- (a) Find the walking speed of secondary school going students.

Answer m/s [2]

As part of BT70 celebrations, staff and students formed a mass display of the school celebratory logo in the school field. Mr Lee assigned specific groups to form part the logo. The scale drawing of the logo is 1 cm : 20 m.



- (b) Estimate the actual distance, in metres, of the logo formed by the Secondary 4 and 5 students.

Answer m [2]

Below are the instructions for the formation of the logo.

Time	Instruction
7.30am – 7.35am	Flag-Raising in classrooms
7.35am – 7.55am	Students to leave their classrooms and reach the school field
7.55am – 8.20am	Formation of BT70 logo in the school field, and photo-taking.
8.20am – 8.30am	Students to leave the school field and reach their classrooms.

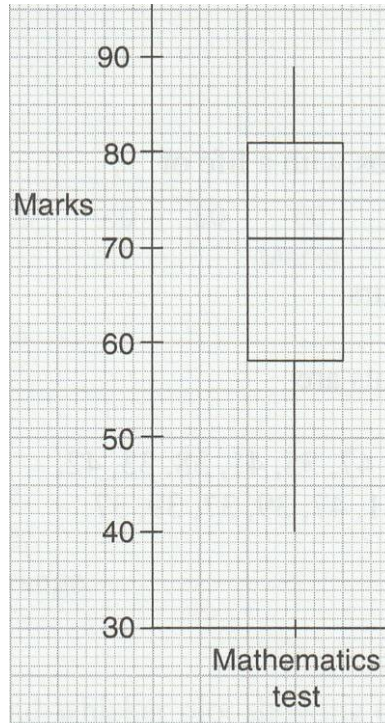
- (c) If the maximum walking distance from the classroom to the school field is 400 metres, determine with working if a Secondary 4 or 5 class will be able to return to their classroom by 8.30am.

Answer

Section B (8 marks)

Answer **one** question from this section. Each question carries 8 marks.

- 11 (a)** The box-and-whisker plot show the distribution of the marks of a Mathematics test of a group of students.



- (i)** Complete the following table.

	Mathematics test
Lowest mark	40
Highest mark	89
Range	
Lower Quartile	
Upper Quartile	
Interquartile Range	
Median mark	

[3]

- (ii)** David observed that the marks of the Mathematics test were evenly distributed. Do you agree?

Answer

.....

.....

[1]

- (iii) The distribution of marks of an English test of the same group of students were noted as follows:

	English test
Range	34
Interquartile Range	10
Median mark	61

Make one comparison of the students in the two subjects.

Answer

.....

..... [1]

- (b) A bag contains 4 blue balls and 3 red balls. Two balls were drawn from the bag at random, one after another.

Find the probability that

- (i) both balls are blue,

Answer [1]

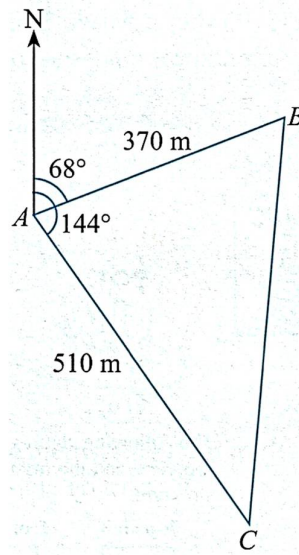
- (ii) both balls are of different colours.

Answer [2]

12 A , B and C are three points on level ground.

The bearing of B from A is 068° , and the bearing of C from A is 144° .

AB is 370m and AC is 510m.



Find

(a) The distance between B and C ,

Answer m [3]

(b) The bearing of C from B ,

Answer [3]

- (c) The shortest distance from C to AB .

Answer m [2]
