West Spring Secondary School
PRELIMINARY EXAMINATION 2022

Mathematics **4048/01**

Paper 1

Secondary 4 EXPRESS / 4 NORMAL (ACADEMIC) OOS /
5 NORMAL (ACADEMIC)

Name _____ ( ) **Date** 29 August 2022

Class _____ **Duration** 2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluids.

Answer **all** questions on the Question Paper.
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 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, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

FOR EXAMINER'S USE	
	/80

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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

Arc length $= r\vartheta$, where ϑ is in radians

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

Trigonometry

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

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

Statistics

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

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

Answer **all** questions

1 One light year is approximately 9 430 billion kilometres.

(a) Express 9 430 billion in standard form.

Answer ..... [1]

(b) A star is approximately 7.6 light years from the Earth.

What is the distance between this star and the Earth?
Give your answer in million kilometres, in ordinary form.

Answer ..... million km [1]

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2 A man bought a car for $25 000.
A few months later, he sold it at a 30% loss.

If he gave a further 2% discount from its selling price, how much was the final price of the car?

Answer $..... [2]

---

3 An n-sided polygon has two of its exterior angles at $60°$ and $40°$.

If the remaining exterior angles are $20°$ each, find the value of n.

Answer n =..... [2]

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4 (a) These are the first four terms of a sequence.

29 23 17 11

Find an expression, in terms of n, for the nth term of the sequence.

Answer ..... [1]

(b) One term in the sequence is -235.

Find the value of n for this term.

Answer n =.....[1]

---

5 It is given that x is 20% lesser than m and y is 30% greater than n.

Determine if $\frac{x}{y}$ is lesser or greater than $\frac{m}{n}$.

Show all your working.

Answer $\frac{x}{y}$ is ..... than $\frac{m}{n}$ [2]

---

6 Find the smallest integer n which satisfies $5n+16>14$.

Answer n =..... [2]

---

7 A map has a scale of 1 : 20 000.

(a) The actual distance between two towns is 3 km apart.

Calculate the distance, in centimetres, represented on the map.

Answer ..... cm [1]

(b) The area of a lake on the map is 150 cm^2.

Calculate, in square kilometres, the actual area of the lake.

Answer ..... km^2 [2]

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8 Solve these simultaneous equations.

$3x + 2y = 5$
$2x - y = 8$

Answer x =.....

y =..... [3]

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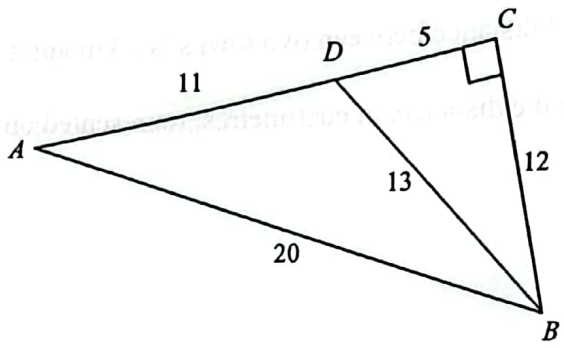
9 Triangle ABC is a right-angled triangle and D is a point on AC.
Given that $AB = 20$ cm, $BC = 12$ cm, $CD = 5$ cm, $BD = 13$ cm and $AD = 11$ cm.



Find, giving each answer as a fraction in its simplest form,

(a) $\tan \angle CAB$,

Answer ..... [1]

(b) $\sin \angle CDB$,

Answer ..... [1]

(c) $\cos \angle ADB$.

Answer ..... [1]

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10 Simplify $\dfrac{1}{x-2}+\dfrac{x}{x^2-3x+2}$.

Answer ..... [3]

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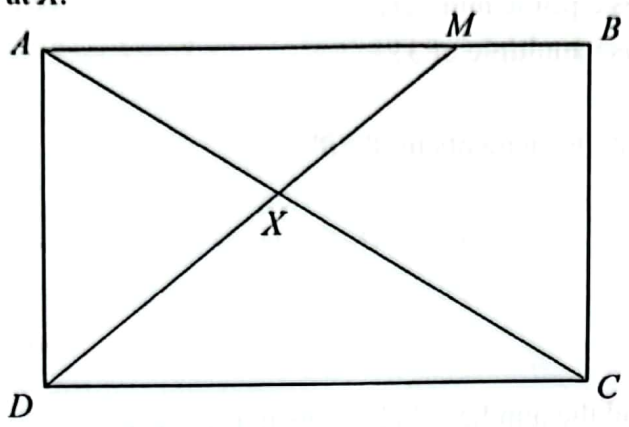
11 $ABCD$ is a rectangle and M is a point on AB.
AC and DM meet at X.



(a) Show that triangles AMX and CDX are similar.

Give a reason for each statement you make.

.....

.....

.....

.....

..... [2]

(b) It is given that the ratio $AM : AB = 3 : 4$.

Find the ratio area of triangle AMX : area of triangle CDX.

Answer ..... : ..... [1]

12 $\xi = \{ x: x \text{ is an integer and } 0 < x \leq 15 \}$

$A = \{ x: x \text{ is a prime number} \}$
$B = \{ x: x \text{ is a multiple of } 3 \}$

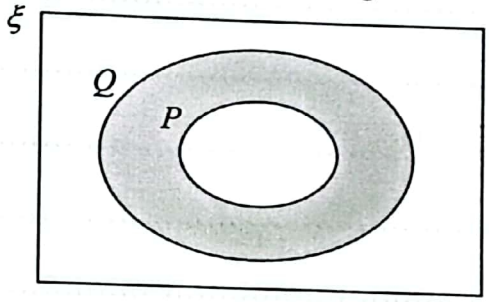
(a) List the elements in $A' \cap B'$.

Answer ..... [1]

(b) Find the number of elements in $(A \cup B)$.

Answer ..... [1]

(c) Use set notation to describe the shaded region.



Answer ..... [1]

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13 **(a)** Simplify $\left(\frac{9}{x^4}\right)^{-\frac{1}{2}}$, leaving your answer in positive index form.

Answer ..... [1]

(b) Given that $8 \div 2^{-14} = 2^k$, find the value of k.

Answer $k =$ ..... [2]

---

14 (a) The numbers 252 and 495, written as the products of their prime factors are

$252 = 2^2 \times 3^2 \times 7$ $\quad\quad$ $495 = 3^2 \times 5 \times 11$

Find

(i) the smallest positive integer, k, such that $252k$ is a perfect cube,

Answer k =..... [1]

(ii) the smallest positive integer, n, such that $252n$ is a multiple of 495.

Answer n =..... [1]

(b) Three train services operate from the same station.
The first service leaves at 20 minutes interval, the second at 25 minutes interval and the third at 35 minutes interval.
All three services leave the station at 06 30.

Find the time when the three services next leave the station together.

Answer ..... [2]

15 In a survey, the number of passengers that the cars carried on a particular stretch of road were recorded.

The table below shows the results.

Number of passengers	1	2	3	4	5
Number of cars	5	11	7	x	2

(a) If the mean number of passengers is 2.5, find the value of x.

Answer $x =$..... [2]

(b) If x is 7, find the median number of passengers.

Answer ..... [1]

(c) If the mode is 2, find the largest possible value of x.

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

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16 **(a)** Factorise completely $2a^2 - 18$.

Answer ..... [2]

(b) Using factorisation, solve $x^2 + 3x - 28 = 0$.

Answer $x =$ ..... or ..... [2]

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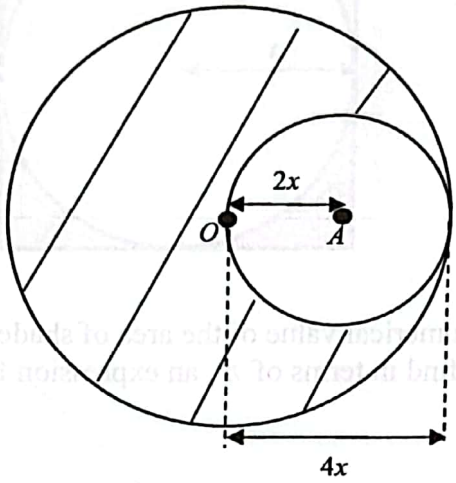
17 The diagram shows 2 circles.
The bigger circle with centre O has a radius of $4x$.
The smaller circle with centre A has a radius of $2x$.



(a) A point is chosen, at random, inside the bigger circle.

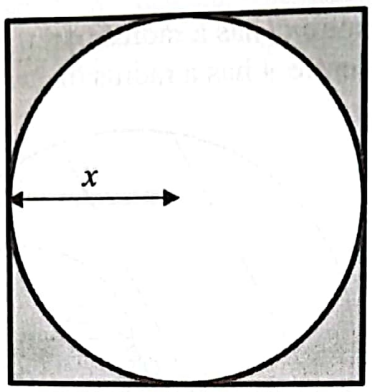
Find, as a fraction in its simplest form, the probability that this point is inside the unshaded region.

Answer ..... [2]

(b) Find, as a fraction in its simplest form, the ratio
area of shaded region: area of unshaded region.

Answer ..... : ..... [2]

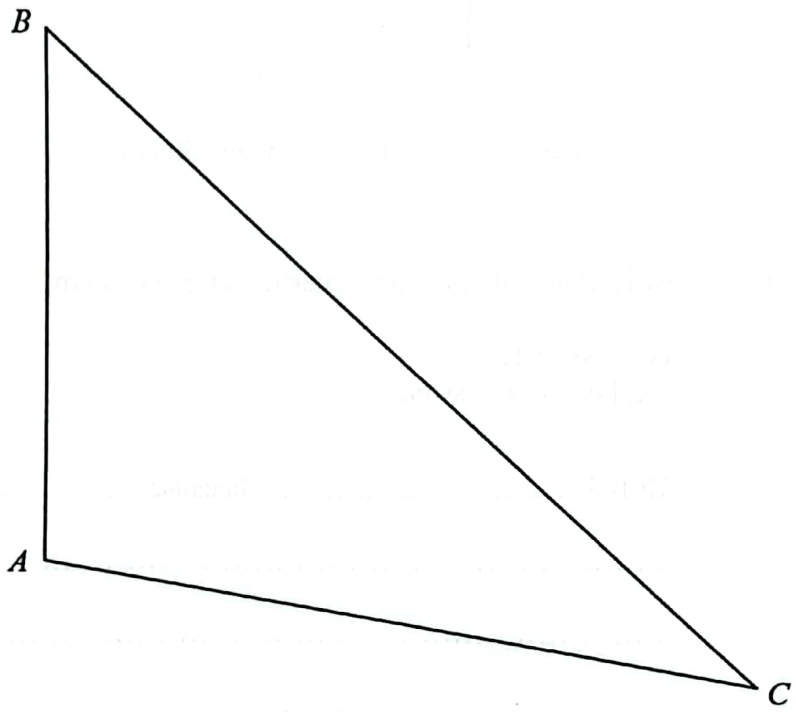
18 The diagram shows a circle of radius x cm, inscribed inside a square.



Given that the numerical value of the area of shaded region and the perimeter of the square is equal, find in terms of π, an expression for the radius of the circle.

Answer ..... [4]

19 The diagram shows the footpaths, AB, BC and AC, across a horizontal field.
B is due North of A.



(a) Find the bearing of C from B.

Answer ..... [1]

(b) Fountain F is on a bearing of 035° from A and on a bearing of 340° from C.

Find and label the position of the fountain F on the diagram. [1]

(c) Statue S is to be placed equidistant from the three footpaths AB, BC and AC.

Find and label the position of the statue S on the diagram. [2]

20 The stem-and-leaf diagram shows the heights, in cm, of plants grown in a nursery.

Stem	Leaf						
5	0	1	1	4			
6	1	2	2	3	4	5	9
7	3	3	4	4	5	6	8
8	2	5					

Key: 5 | 0 means 50 cm

(a) Billy claims that the interquartile range is 35 cm.

Is he correct?
Explain your answer.

Billy is .....because.....

.....

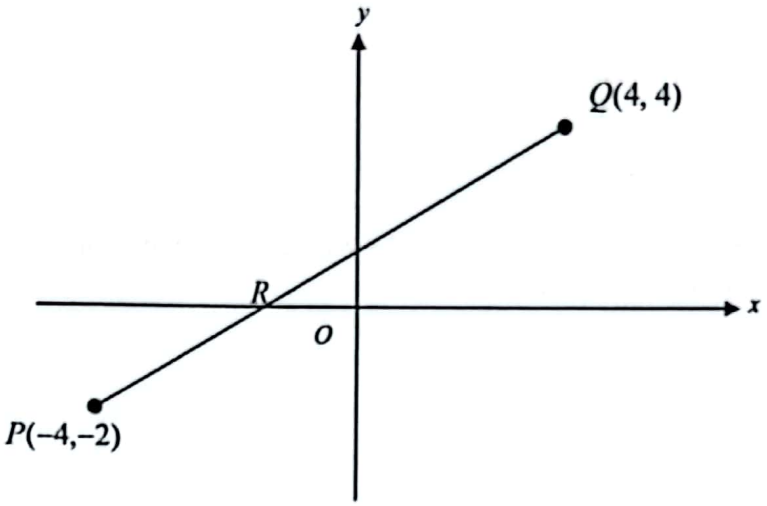
.....

..... [2]

(b) If two plants are chosen at random, find the probability that the height of one plant is less than 62 cm and the other plant is greater than or equal to 74 cm.

Answer ..... [2]

21 The diagram shows a straight line passing through the points $P(-4,-2)$, R and $Q(4, 4)$. R is a point on the x-axis.



(a) Find the length of the line segment PQ.

Answer PQ = ...units [2]

(b) Find the equation of the line.

Answer ..... [2]

(c) State the coordinates of the point R.

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

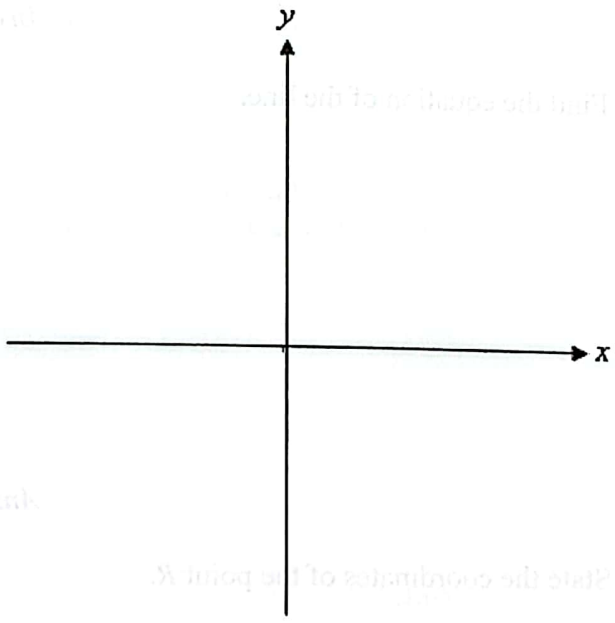
22 **(a)** Express $x^2 - 8x + 2$ in the form $(x-h)^2 + k$.

Answer ..... [2]

(b) Hence, solve the equation $x^2 - 8x + 2 = 0$, giving your answers correct to two decimal places.

Answer $x =$.....or ..... [2]

(c) Sketch the graph of $y = x^2 - 8x + 2$ on the axes below.
Indicate the points where the graph crosses the axes and the turning point clearly.

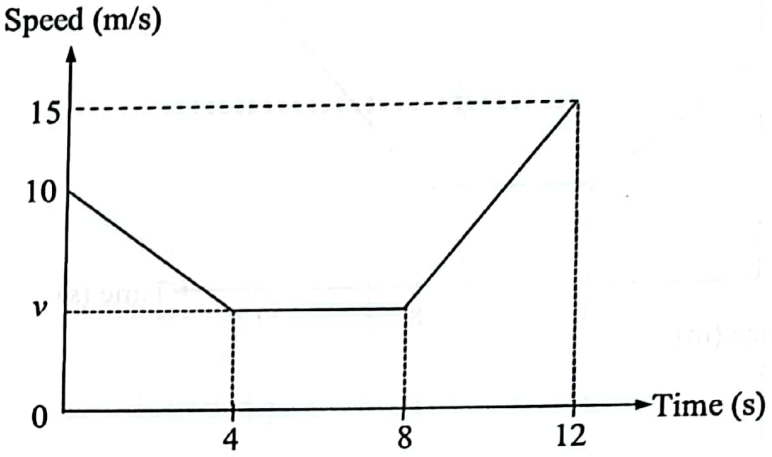


[2]

(d) Write down the equation of the line of symmetry of the graph.

Answer ..... [1]

23 The diagram shows the speed-time graph of a particle over a period of 12 seconds.
The particle is uniformly decelerated from 10 m/s to v m/s in the first 4 seconds.
It then maintains at this speed for the next 4 seconds and accelerates uniformly to 15 m/s within the next 4 seconds.
The total distance travelled in the first 8 seconds is 50 m.



(a) Show that the value of v is 5.

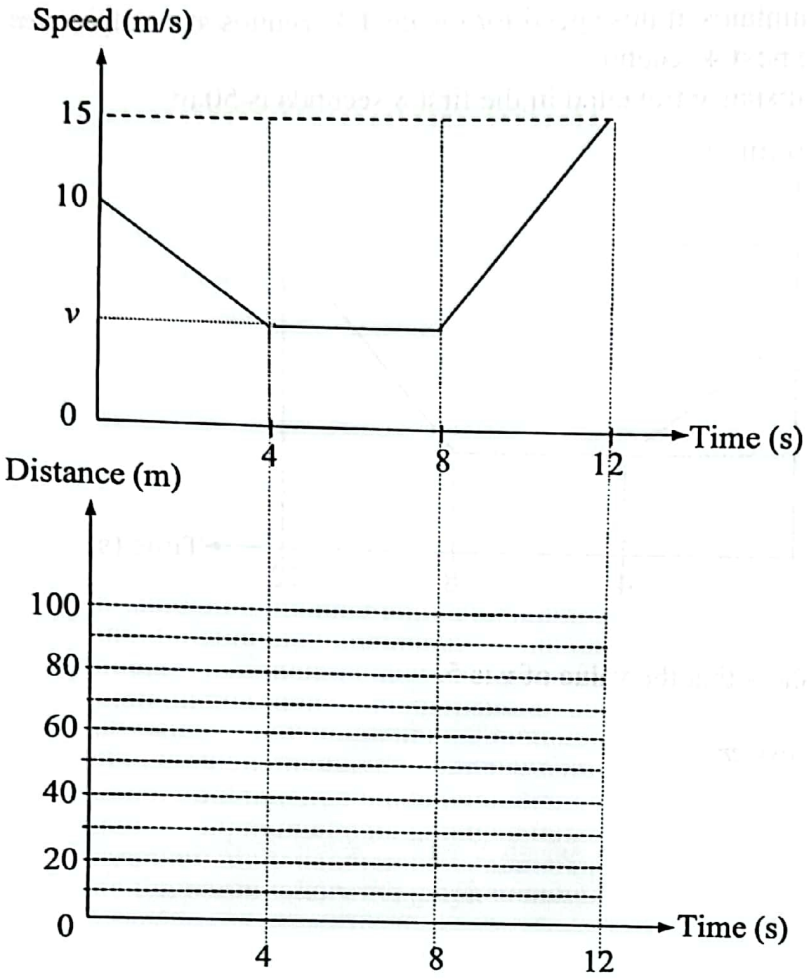
Answer

[2]

(b) Find the speed of the particle at the 9th second.

Answer .....m/s [2]

(c) Complete the corresponding distance-time graph on the grid provided below.



[3]

END OF PAPER 1