NAVAL BASE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024

O

Name _____ **( )** **Class** _____

MATHEMATICS

4052/01

Paper 1

21 August 2024

Candidates answer on the Question Paper

2 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index 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.

Answer **all** questions.
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 π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is **90**.

Item	***For examiner's use***
Presentation	
Accuracy	
Units	
Total	
Parent's Signature	

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Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

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

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

[Turn over

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Answer **all** the questions.

1 Calculate $\sqrt[4]{13.5^2 - \frac{6.56}{0.37}}$.

Answer …….. [1]

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2 Simplify

(a) $3x^2 \times 4y^5$.

Answer …….. [1]

(b) $3(2x-1)-5$.

Answer …….. [1]

---

3 Factorise completely $2x^3 - 13x^2 + 6x$.

Answer …….. [2]

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4 The sine of an angle is 0.6, find the two possible values for angle.

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

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5 A class of 12 boys and 8 girls took a test.
The girl's marks were 3, 6, 7, 8, 9, 9, 10 and 10.

(a) Find the mean mark for the girls.

Answer ……mark [1]

(b) The mean mark for the boys were 8.0.

Find the mean mark for the whole class.

Answer ……mark [2]

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6 **(a)** The number $12\,250 \times \frac{p}{q}$ is a perfect cube. p and q are prime numbers.

Find p and q.

Answer p = ……..……..

q = ……[3]

(b) x is a number between 700 and 800.

The highest common factor of x and 12 250 is 250.

Find the smallest possible value of x.

Answer x = ..…….…….. [1]

[Turn over

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7 Given that $81^{2x} \times 9^{x} = 27$, find x.

Answer ……. [2]

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8 Raj has 120 one-centimetre cubes.
He arranges all of the cubes into a cuboid.
The perimeter of the top of the cuboid is 20 cm.
Each side of the cuboid has a length greater than 3 cm.

Find the height of the cuboid.

Answer ……. cm [2]

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9

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Rearrange the formula to make g the subject.

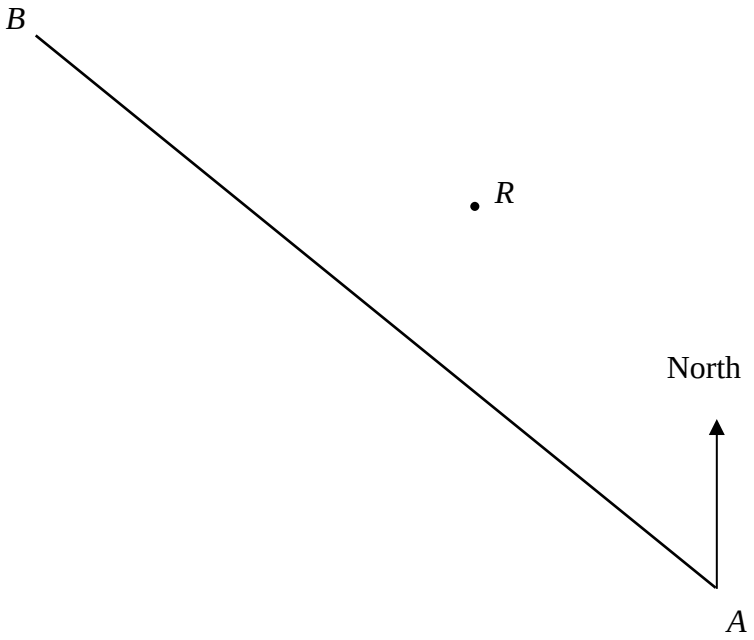
Answer g =…….…….. [3]

[Turn over

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10

Scale: 1 cm to 5 km



In the scale drawing, *R* is the centre of a rock bed, *A* is a ship and *B* is a port.
The line *AB* shows the ship's course.

(a) Measure the bearing of *B* from *A*.

Answer ……° [1]

(b) The rock bed covers a 25 km radius.

If the ship were to stay on course, state the distance at which the ship will first hit the rock bed.

Answer ……km [2]

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11 The table below shows the amount of time spent playing online games by a group of children in one particular week.

Time (h hours)	Frequency
$0 < h \leq 2$	4
$2 < h \leq 4$	9
$4 < h \leq 6$	15
$6 < h \leq 8$	13
$8 < h \leq 10$	7
$10 < h \leq 12$	2

(a) **(i)** Calculate an estimate of the mean time spent playing online games that week.

Answer ……hours [1]

(ii) Explain why this is only an estimate of the mean time these children spent playing online games that week.

Answer …….. [1]

(b) Calculate an estimate of the standard deviation of the time spent playing online games that week.

Answer ……hours [2]

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12 Solve the simultaneous equations.

$$\frac{x}{4} - \frac{y}{2} = 2$$
$$3x = 19 + 4y$$

You must show your working.

Answer x = ……

y = …… [3]

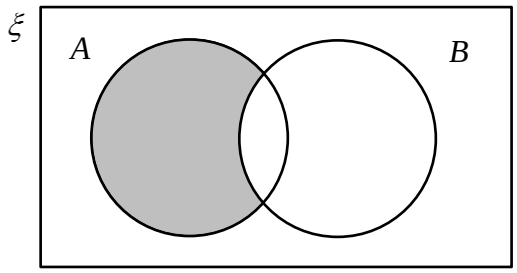
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13 **(a)** Factorise $5xy - 20y$.

Answer …….…….. [1]

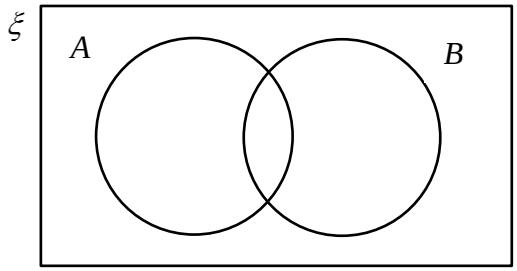
(b) **(i)** Use set notation to describe the shaded region.



Answer …….…….. [1]

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

Answer



[1]

[Turn over

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14 **(a)** A bag contains black, blue and yellow balls.
A ball is picked at random from the bag.

The probability that the ball is blue is $\frac{5}{9}$.

The probability that the ball is yellow is $\frac{2}{15}$.

Find the probability that the ball is black.

Answer …….. [1]

(b) Another bag contains 10 red balls, 7 white balls and 8 blue balls.
A further *n* white balls are added to the bag.

The probability of picking a white ball is now $\frac{2}{5}$.

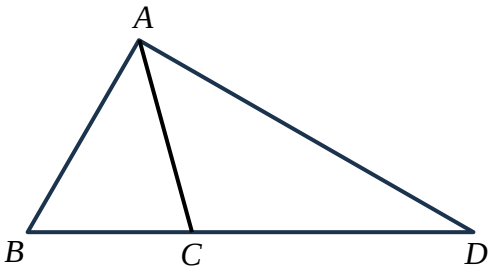
Find the value of *n*.

Answer n = …….. [2]

[Turn over

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15



In the diagram, *BCD* is a straight line and $BC : CD = 3 : 5$.

Calculate the area of triangle *ABC* as a percentage of the area of the triangle *ABD*.

Answer ……% [2]

---

16 *x* and *y* are related such that *x* is inversely proportional to the square of *y*.
If *y* is increased by 400%, find the percentage change in *x*.

Answer ……% [3]

[Turn over

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17 The numbers 1 to 100 are arranged in a table as shown below.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
91	92	93	94	95	96	97	98	99	100

A ***L***-shaped shaded frame can be placed around various numbers throughout the table.

$\boldsymbol{L}_n$ is used to refer to the shaded frame that is drawn around a particular number.
For example, $\boldsymbol{L}_2$ refers to the shaded frame shown above drawn around the number 2.

(a) State the largest $\boldsymbol{L}_n$.

Answer $\boldsymbol{n}$ = …….…….. [1]

(b) Write and simplify an expression, in terms of n, for the sum of the numbers in $\boldsymbol{L}_n$.

Answer …….…….. [2]

(c) Explain why the sum of the numbers is always a multiple of 3.

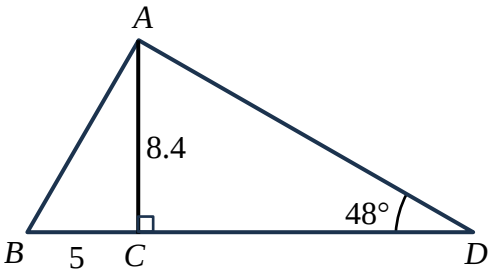
Answer ……...

……. [1]

[Turn over

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18



In the triangle *ABD*, *AC* is perpendicular to *BD*.
Angle *ADC* = 48°, *AC* = 8.4 cm and *BC* = 5 cm.

Calculate
(a) angle *ABC*,

Answer ……° [2]

(b) *AD*.

Answer ……cm [2]

[Turn over

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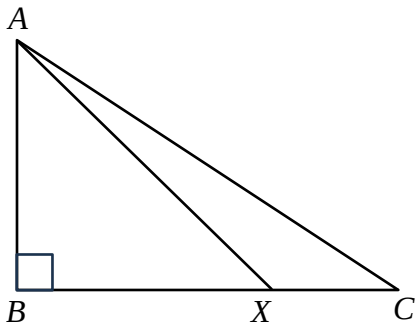
19 Solve the equation $x^2 + 5x - 16 = 0$ by completing the square.
Give your solutions correct to two decimal places.

Answer x = ……..… or ……..… [4]

[Turn over

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20



In triangle ABC, angle $ABC = 90°$, $BX = 2XC$ and $\sin \angle AXC = \frac{3}{5}$.

Express as a fraction in its lowest terms,

(a) $\tan \angle AXB$,

Answer …….. [2]

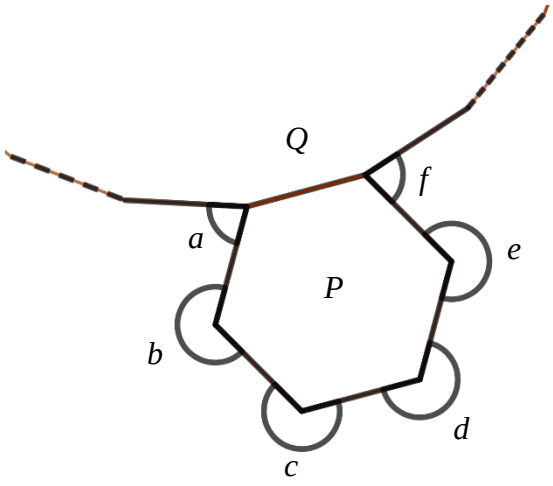
(b) $\tan \angle ACB$.

Answer …….. [2]

[Turn over

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21 The diagram shows a regular hexagon P and a regular n-sided polygon Q.
Polygon Q has an exterior angle of 18°.



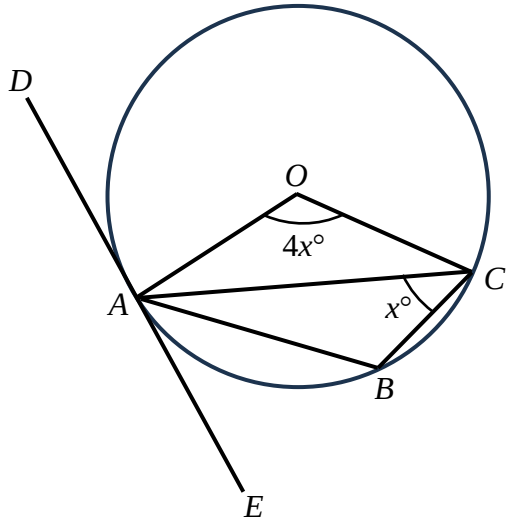
Find the sum of angles a, b, c, d, e and f.

Answer ……° [4]

[Turn over

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22



A, *B* and *C* are points on the circle, centre *O*.
DE is a tangent to the circle at *A*.
Angle $AOC = 4x°$ and angle $ACB = x°$.

Find, in terms of *x*, the following.
Give a reason for each step of your answer.

(a) angle *ABC*,

Answer ……° [2]

(b) angle *BAE*.

Answer ……° [2]

[Turn over

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23 A vaccine was introduced to a virus in an experiment.

The number, N, of virus t hours after being introduced to the vaccine is given by

$$N = v \times 0.9^{2t},$$

where v is the amount of vaccine introduced.

(a) After 1 hour, the number of virus has decreased to 81 000.

Find v.

Answer v = …….. [1]

(b) Find in terms of k, the number of virus when $0.81^t = k$.

Answer N = …….. [1]

(c) Find the decrease in the number of virus after 2 hours as a percentage of the number of virus at the beginning.

Answer ……% [2]

(d) Which of these diagrams represent the graph of N against t?

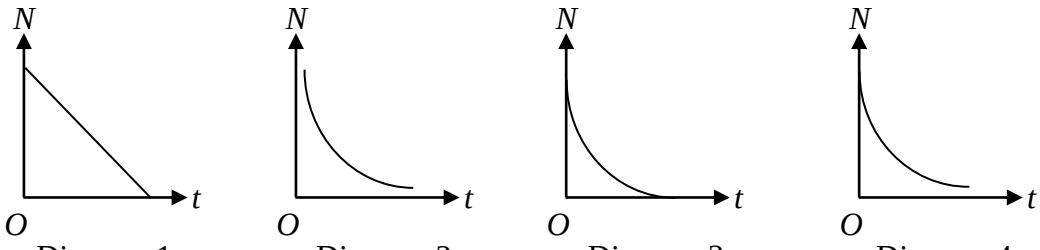


Diagram 1 Diagram 2 Diagram 3 Diagram 4

Answer Diagram …….. [1]

[Turn over

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24 **(a)** **Underline** the following ratios that are equivalent to the ratio $a : b$.

Answer

$\frac{1}{b} : \frac{1}{a}$ $\quad a^3 : b^3$ $\quad 3a : 3b$ $\quad a+1 : b+1$

[2]

(b) John and Sam each have an amount of money.
The ratio John's amount : Sam's amount = 6 : 2.

John gives Sam $13.
The new ratio John's amount : Sam's amount = 2 : 5.

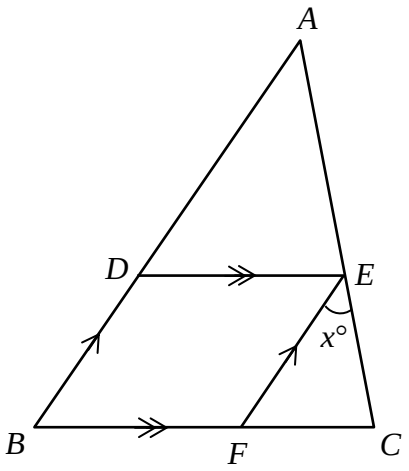
Find how much money John has now.

Answer $ ..... [4]

[Turn over

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25



The diagram shows triangle *ABC* and parallelogram *BDEF*.
FE bisects angle *DEC* and angle *FEC* = $x°$.

(a) Find angle *ECF* in terms of *x*.
Give a reason for each step of your answer.

Answer ……

……

……[2]

(b) Show that triangle *AED* is similar to triangle *ECF*.

Answer ……

……

……

……[3]

(c) State another triangle that is similar to *AED* and *ECF*.

Answer Triangle …….. [1]

[Turn over

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26 A baking school offers beginner, intermediate and advanced baking classes on weekdays and weekends in August this year.

The matrix **B** shows the number of participants attending the baking classes in August.

$$\mathbf{B} = \begin{array}{c} \begin{matrix} \text{beginner} & \text{intermediate} & \text{advanced} \end{matrix} \\ \begin{pmatrix} 22 & 20 & 9 \\ 8 & 10 & 11 \end{pmatrix} \end{array} \begin{matrix} \\ \text{weekdays} \\ \text{weekends} \end{matrix}$$

(a) The fees for the beginner, intermediate and advanced baking classes are \$30, \$40 and \$50 respectively.

Represent the class fees by a 3×1 matrix **F**.

Answer **F** = [1]

(b) Evaluate the matrix **C = BF**.

Answer **C** = [2]

(c) State what the elements of **C** represent.

Answer ……...

...……[1]

[Turn over

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(d) In September, there were a different number of participants attending baking classes.

The number of participants attending beginner classes decreased by 20%.
The number of participants attending intermediate classes increased by 10%.
The number of participants attending advanced classes tripled.

Calculate the percentage increase in the total amount of fees between the August and September classes.

Answer ……% [3]

-----End of Paper -----

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