Index Number	Class	Name	Calculator's model

CHIJ ST JOSEPH'S CONVENT
PRELIMINARY EXAMINATION

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MATHEMATICS **4048/01**

Paper 1

Secondary 4 Express / 4 Normal Academic (O level) / 5 Normal Academic

Friday, 27 August 2021
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number, class, name and calculator model in the spaces at the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.
Working in pencil will not be marked.
The total of the marks for this paper is 80.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.
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
80

This document consists of **19** printed pages.

Setter(s) : Mrs Lee Ann Gee

[Turn over

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 = $4\pi r^2$

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

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

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

Arc length = $r\theta$, where θ 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

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

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

Answer **all** the questions.

For Examiner's Use

1 Given that $\frac{1}{64} = 2^n$, find n.

Answer $n =$ ..... [1]

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2 List the integer values of x which satisfy the inequality $x < 3x - 4 \leq 12$.

Answer ..... [3]

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3 **(i)** Factorise completely $2x^2 + x - 10$.

Answer ..... [1]

(ii) **Hence**, factorise completely $2(2y-3)^2 + (2y-3) - 10$. Write your answer as simply as possible.

Answer ..... [2]

For Examiner's Use

4 **(a)** Find the prime factors of 1080, giving your answer in index form.

Answer ..... [1]

(b) Two integers, P and Q, can be written as products of prime factors.

$$P = a^3 \times b^c \times 5,$$

$$Q = a^2 \times b^{c+1}.$$

The lowest common multiple (LCM) of P and Q is 1080.

(i) Given that $a < b$, write down the values of a, b and c.

Answer a = ..., b =....., c =..... [2]

(ii) Find the highest common factor (HCF) of P and Q.

Answer ..... [1]

For Examiner's Use

5 If $a - b = -6$, $ab = 40$, $a > 0$ and $b > 0$, evaluate

(i) $(2a + 2b)^2$,

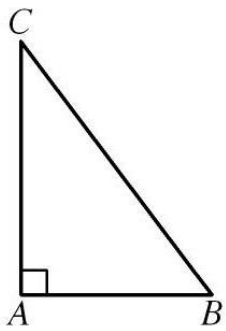
Answer .....…… [2]

(ii) $(2a)^2 - (2b)^2$.

Answer .....…… [3]

For Examiner's Use

6 The diagram shows a triangle with base AB and height AC.



The area of the triangle is increased by 125% when AB is reduced by 10% and AC is increased by x%. Find the value of x.

Answer $x =$ ……[3]

For Examiner's Use

7 **(i)** A result of global warming is that the ice of some glaciers is melting. Twelve years after the ice disappears, tiny plants, called lichen, start to grow on the rocks.

Each lichen grows approximately in the shape of a circle. The relationship between the diameter of this circle and the age of the lichen can be approximated with the formula, $d = 7\sqrt{t-12}$ for $t \geq 12$, where d represents the diameter of the lichen in millimetres, and t represents the number of years after the ice has disappeared. Calculate the diameter of the lichen, 16 years after the ice disappeared.

Answer ……...mm [1]

(ii) Anniston measured the diameter of some lichen and found it to be 35 millimetres. How many years ago did the ice disappear?

Answer ....……..……years [2]

For Examiner's Use

8 **(a)** A 15% profit is earned on the cost price of a television set if it is sold for \$1426. Find

(i) the profit,

Answer \$…… [2]

(ii) the cost price of the television set.

Answer \$…… [2]

(b) Another television set with the same cost price is sold for \$1007.50. Express the loss as a percentage of the cost price of the television set.

Answer ……% [2]

For Examiner's Use

9 **(a)** y is proportional to x^m. Write down the value of m when

(i) y hours is the time taken to travel a distance x km at a constant speed,

Answer $m =$ …… [1]

(ii) y cm^2 is the area of a circle of radius x cm.

Answer $m =$ …… [1]

(b) The force, F, between two particles is inversely proportional to the square of the distance between them. The force is 54 units when the distance between the particles is r metres. Find the force when the distance is $3r$ metres.

Answer ……units [2]

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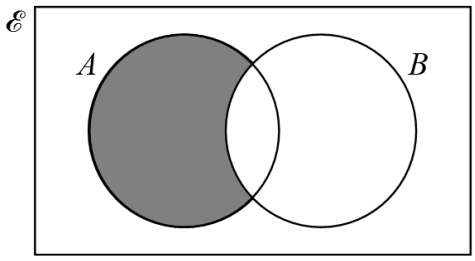
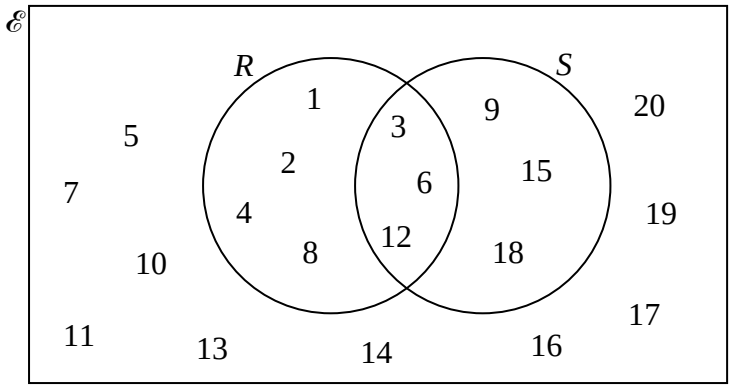
10 **(a)** Use set notation to describe the shaded region.



Answer ……..... [1]

(b) $\mathscr{E} = \{x: x \text{ is an integer, } 1 \leq x \leq 20\}$. The Venn diagram shows the elements of ε and two sets, R and S.



Use one of the symbols below to complete each statement.

$\varepsilon \quad \in \quad \notin \quad \subset \quad \not\subset$

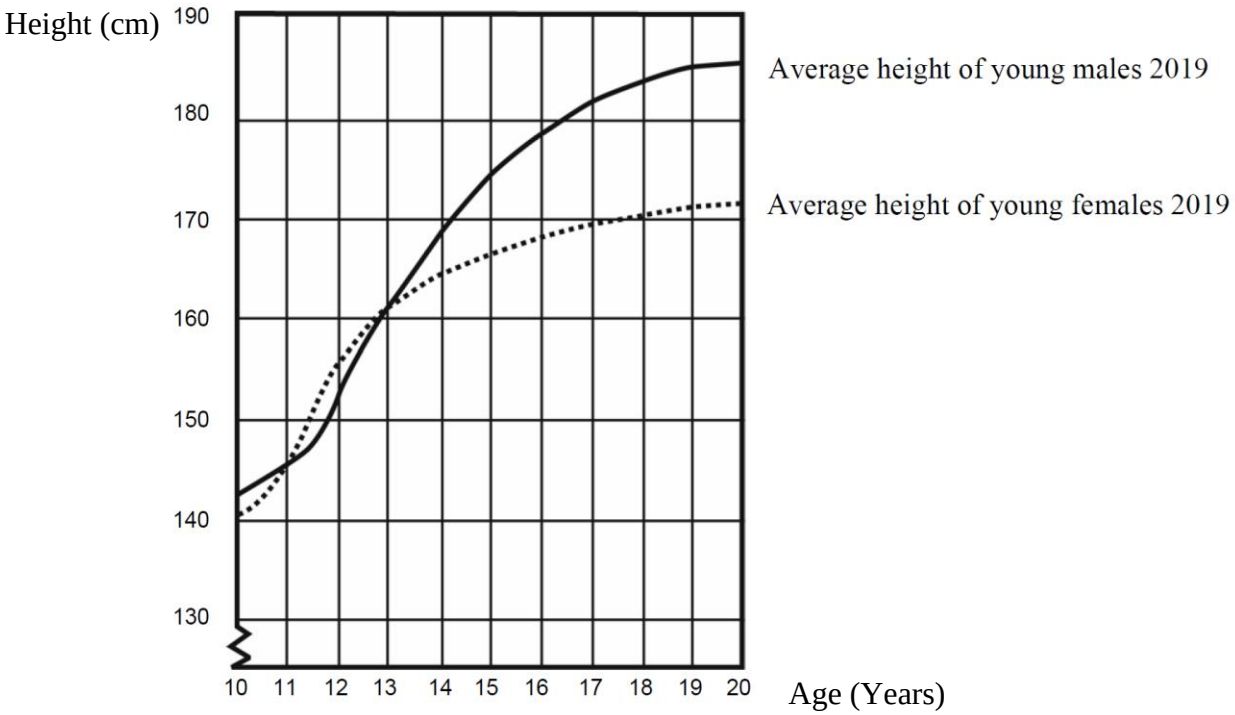
(i) $R \cap S$ ……..... S. [1]

(ii) $\{19, 20\}$ ……..... S. [1]

(iii) 3 ……..... R. [1]

For Examiner's Use

11 In 2019, the average height of both young males and young females in a certain country is represented in this graph.



(a) Since 2001, the average height of 20-year-old females has increased by 2.3 cm, to 170.6 cm. What was the average height of a 20-year-old female in 2001?

Answer …….....……cm [1]

(b) Explain how the graph shows that on average the growth rate for girls slows down after 12 years of age.

Answer

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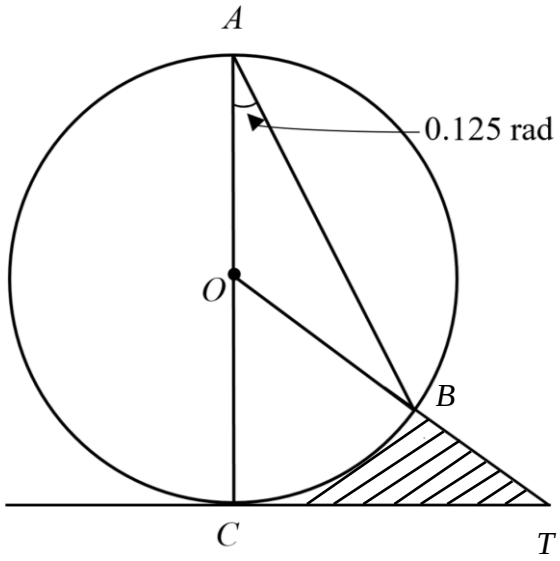
..... [1]

12

For Examiner's Use



In the diagram, AC is the diameter of the circle, TC is the tangent to the circle and OBT is a straight line. Given that $AC = 8$ cm, and $\angle OAB = 0.125$ rad, find

(a) the area of the minor sector BOC,

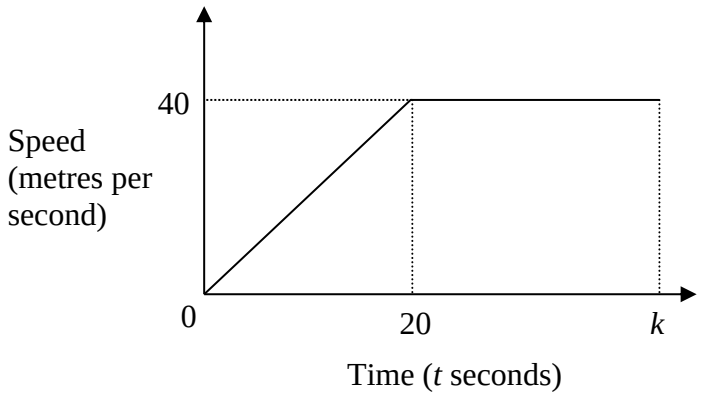
Answer ……cm^2 [2]

(b) the area of the shaded region bounded by minor arc BC, BT and CT.

Answer ……cm^2 [3]

For Examiner's Use

13 The diagram is the speed-time graph for the first k seconds of the motion of an object.



(a) Find the acceleration when $t = 6$.

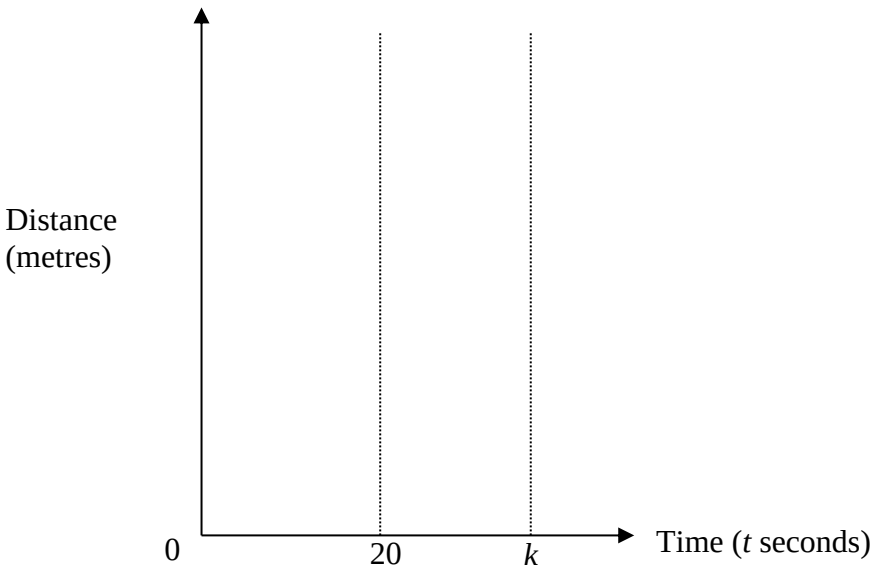
Answer ……..…… m / s ^{2} [2]

(b) The distance travelled in the first k seconds is 920 m. Find the value of k.

Answer k = ……..…… [2]

(c) On the axes in the answer space, sketch the distance-time graph for the first k seconds of the motion of the object. [2]

Answer

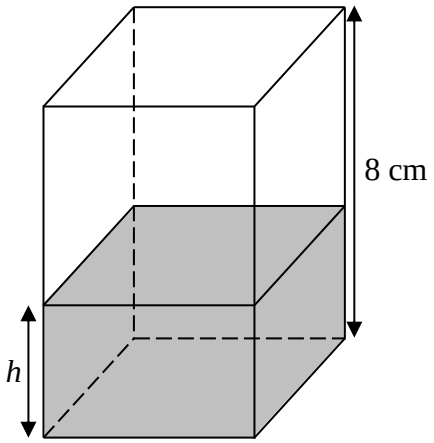


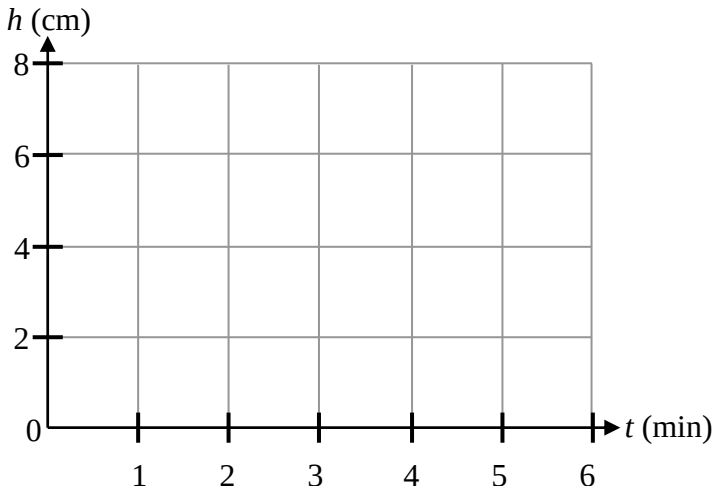
14 Two containers are being filled with water flowing at a constant rate from two similar taps. Containers *A* and *B* have the same square bases and are both 8 cm high.
It is given that both containers are empty initially and it takes 6 minutes and 5 minutes to fill containers *A* and *B* respectively.
Sketch the graph of the height of the water, *h* cm, against the time after the tap is turned on, *t* minutes, for each container.

For Examiner's Use

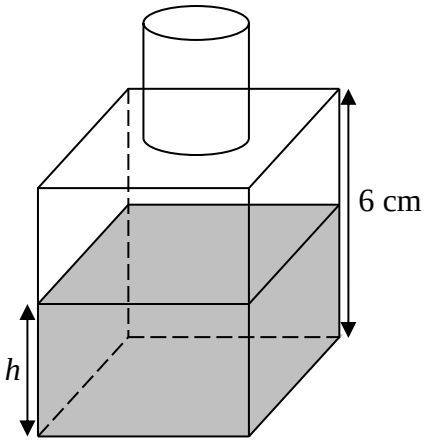
Answer [3]

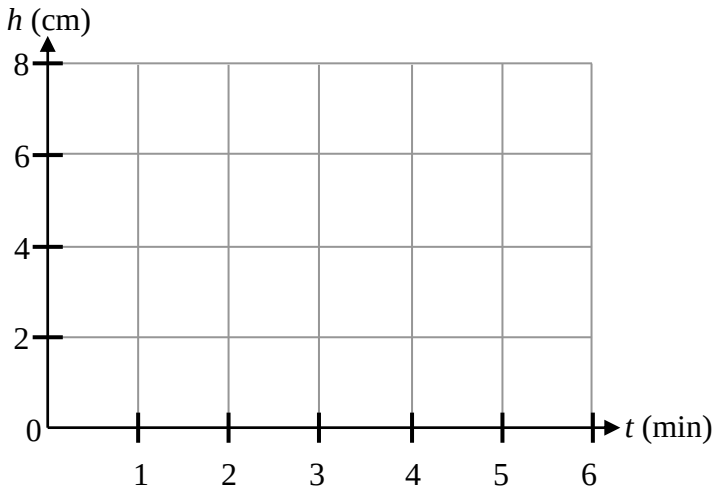
Container *A*





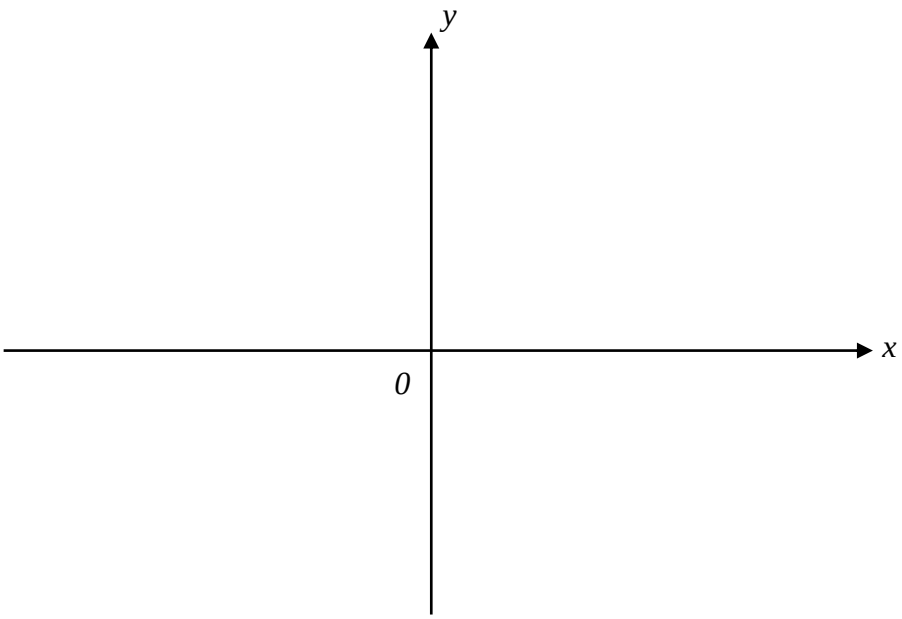
Container *B*





For Examiner's Use

15 (a) (i) Sketch the graph of $y = -(x-3)(x+4)$.
Label clearly the x-intercept(s), y-intercept and the turning point.
Answer (a)(i) [2]

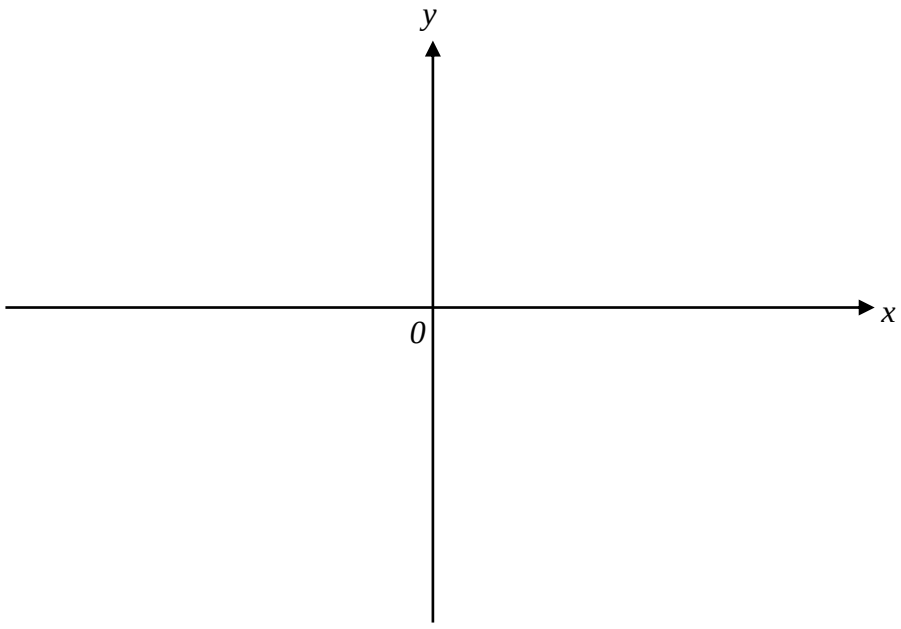


(ii) State the equation of the line of symmetry of $y = -(x-3)(x+4)$.

Answer ……...…… [1]

(b) Sketch the graph of $y = \frac{1}{x^2}$.

Answer (b) [1]



16 The diagram below is the map of a field where a treasure is hidden. It is given that the treasure is at the intersection of the following:

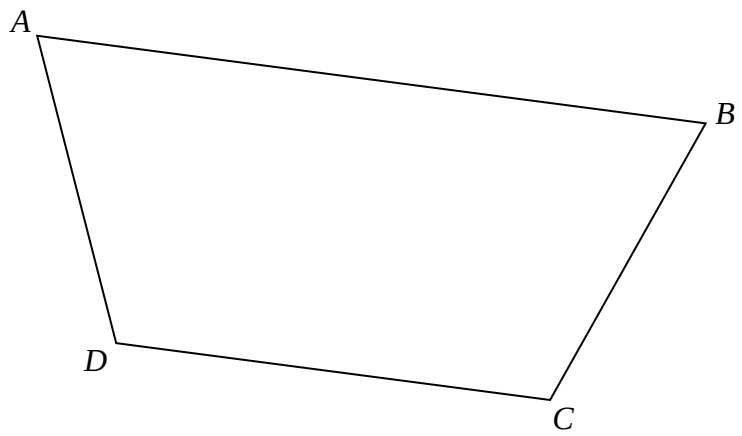
I. Angle bisector of angle *DAB*,

II. Perpendicular bisector of *C* and *D*.

By construction, indicate with the point *X*, where the treasure is hidden.
[Show all construction lines clearly.] [3]

For Examiner's Use

Answer



For Examiner's Use

17 Mr Li invests \$5000 at the beginning of every year for 10 years in a savings scheme that pays 4 % per annum compound interest.

(a) How much interest will Mr. Li earn at the end of 2 years?

Answer \$……..……..…….……..…….. [3]

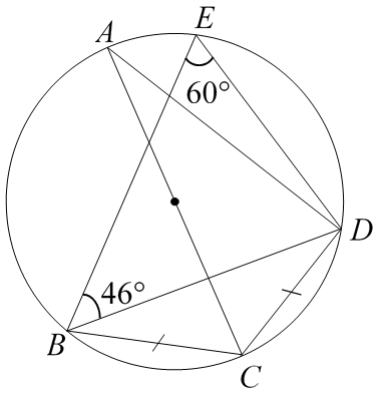
(b) An algebraic formula in Mathematics states that $1 + x + x^2 + \ldots + x^{n-1} = \frac{1-x^n}{1-x}$,

for all real values of x. Use the formula to calculate the total interest Mr. Li will earn at the end of 10 years. Give your answer correct to the nearest dollar.

Answer \$……..……..…….……..…….. [3]

For Examiner's Use

18 In the diagram, $BC = CD$, $\angle EBD = 46°$ and $\angle BED = 60°$. AC is the diameter of the circle. Stating your reasons clearly, calculate



(a) $\angle BCD$,

Answer ……..…..…… ° [1]

(b) $\angle CDE$,

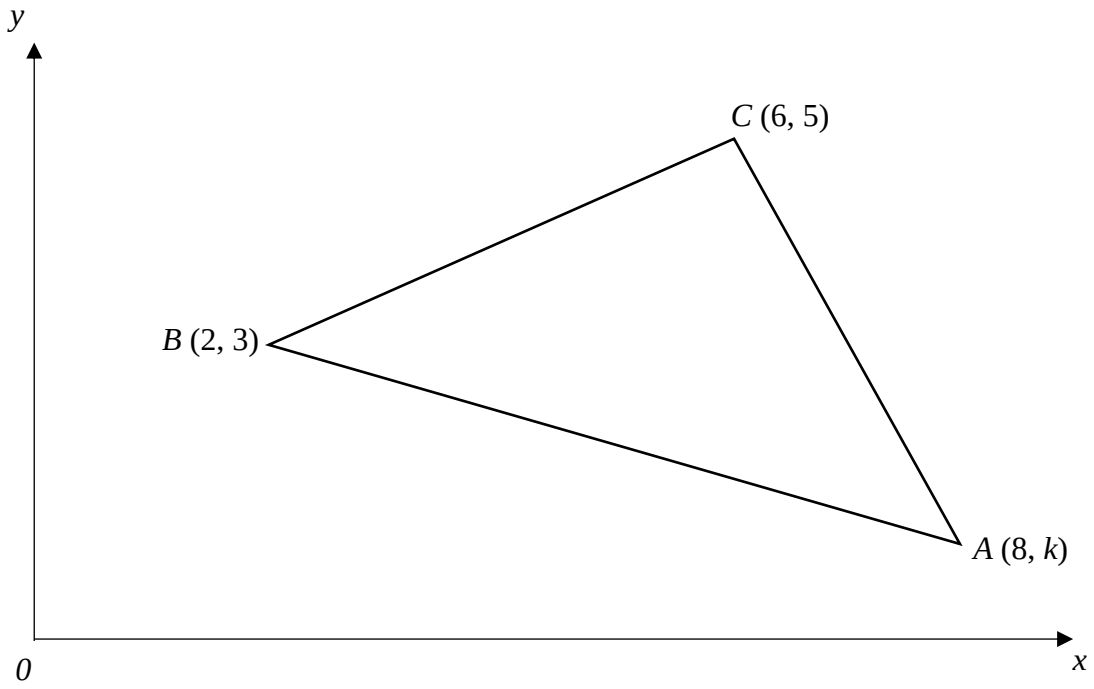
Answer ……..…..…… ° [2]

(c) $\angle ADE$.

Answer ……..…..…… ° [2]

For Examiner's Use

19 Solutions to this question by accurate drawing is not accepted.
In the diagram, *ABC* is a triangle, where *A* is (8, *k*), *B* is (2, 3) and *C* is (6, 5).



(a) Find the gradient of *BC*.

Answer ……..……..... [1]

(b) (i) Given that the area of triangle *ABC* is 10 units^2, form an equation in *k*.

Answer ……..……..... [2]

(ii) Hence, find the value of *k*.

Answer *k* = ……..……..... [2]

For Examiner's Use

20 The performance of the students in two classes in a Mathematics quiz is given in the table below.

Class Respect					
Marks (x)	$0 < x \leq 10$	$10 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$
Frequency	4	10	13	18	5

Class Integrity
Mean mark = 27.5
Standard deviation = 8.2

(a) For Class Respect, calculate an estimate of

(i) the mean,

Answer ……..…… [1]

(ii) the standard deviation.

Answer ……..…… [2]

(b) Make two comparisons between the marks of Class Respect and Class Integrity.

Answer

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[2]

End of paper

Answers for checking

Qn	Answer
1	-6
2	3, 4, 5
3(i)	$(2x+5)(x-2)$
3(ii)	$(4y-1)(2y-5)$
4(a)	$2^3 \times 3^3 \times 5$
4(b)	$a=2, b=3, c=2$
4(c)	36
5(i)	784
5(ii)	–336
6	150
7(i)	14
7(ii)	$t=37$
8(a)(i)	\$186
8(a)(ii)	\$1240
8(b)	18.75%
9(a)(i)	1
9(a)(ii)	2
9(b)	$F=6$
10(a)	$A \cap B'$
10(b)	(i) $\subset$ (ii) $\not\subset$ (iii) $\in$
11(a)	168.3 cm
11(b)	The **rate of change** of the graph for the young females decreases from 12 years on.
12(a)	2cm^2
12(b)	$0.0426\ \text{cm}^2$
13(a)	$2\ \text{ms}^{-2}$
13(b)	$k = 33$
15(a)(ii)	$x = -0.5$
17(a)	\$608
17(b)	\$12 432
18(a)	120°

Qn	Answer
18(b)	104°
18(c)	14°
19(a)	$\frac{1}{2}$
19(b)(ii)	$k = 1$
20(a)(i)	27
20(a)(ii)	11.1