Full Name	Class Index No	Class

Anglo-Chinese School
(Barker Road)

PRELIMIMARY EXAMATIONS
SECONDARY FOUR EXPRESS

MATHEMATICS
4052
PAPER 2

2 HOURS 15 MINUTES

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
Write in dark blue or black pen.

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 terms of 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.

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Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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1 **(a)** It is given that $s = ut + \frac{1}{2}at^2$.

(i) Find s when $u = 0$, $a = 0.5$ and $t = 13$.

Answer $s =$ _____ [1]

(ii) Rearrange the formula to make a the subject.

Answer $a =$ _____ [2]

(b) Solve $\frac{9}{x-4} = 2x - 1$.

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

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(c) Solve these simultaneous equations.

$$4x - 3y = 18$$

$$6x + 2y = 1$$

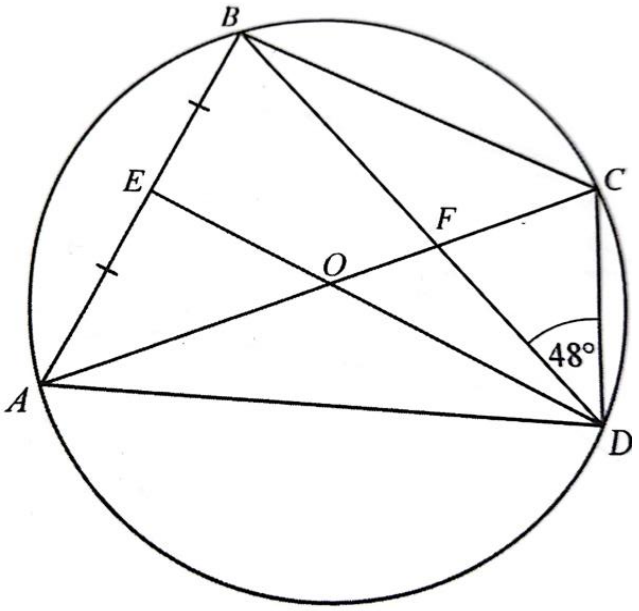
You must show your working.

Answer $x =$ _____

Answer $y =$ _____ [3]

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2



The diagram shows a circle *ABCD*, centre *O*.
E is the midpoint of the chord *AB*. *ED* passes through *O*.
F is the point of intersection of *BD* and diameter *AC*.
Angle *BDC* = 48°.

(a) **(i)** Show that triangle *CFD* is similar to triangle *BFA*.
Give a reason for each statement you make.

_____

_____

_____

_____

_____ [2]

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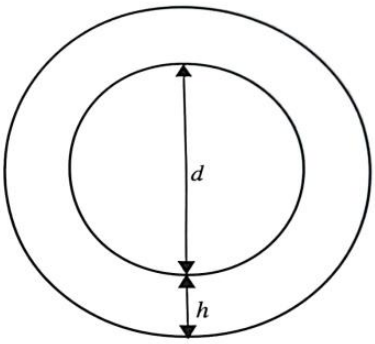
(ii) $AE = 5$ cm.
Find the area of triangle ABC.

Answer _____ cm^2 [4]

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(b) An odometer keeps track of the distance travelled by a vehicle by keeping track of the revolutions of a car tyre. The diagram below shows a car tyre and a simplified graphical representation of it.





In real life, this tyre has the following technical information on its sides:

215/60 R16

R16 indicates the rim has diameter $d = 16$ inches.
215/60 means the tyre has a width of 215 mm, and the thickness h is 60% of the width.
Taking 1 inch = 2.54 cm,

(i) Find the circumference of the tyre in metres.

Answer _____m [2]

(ii) If the odometer registers 50 complete revolutions, calculate the distance travelled by the vehicle.

Answer _____m [1]

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3 The number of micro-organisms, y, in a test tube after t days is shown in the table below. The relationship between y and t can be modelled by the equation $y = 10(2^t)$.

(a) Find the value of q.

t	0	1	2	3	4	5	6
y	10	20	40	80	q	320	640

Answer $q =$ _____ [1]

(b) On the grid opposite, draw the graph of $y = 10(2^t)$ for $0 \le t \le 6$. [3]

(c) **(i)** By drawing a tangent, find the gradient of the curve when $t = 3$.

Answer _____ [2]

(ii) What does this gradient represent?

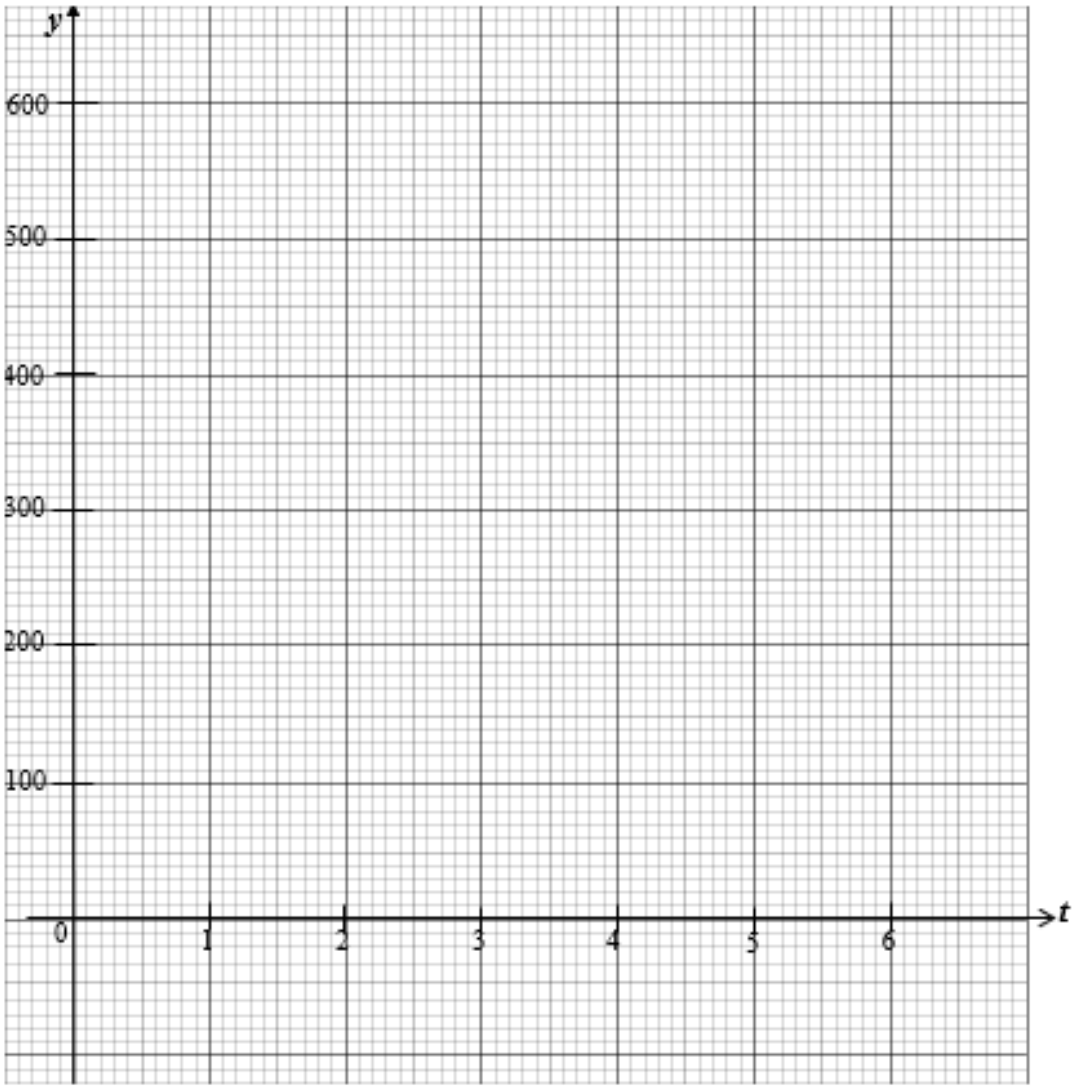
_____

_____ [1]

(d) The number of micro-organisms in another test tube is given by the equation $y = -80t + 600$.
By drawing the line $y = -80t + 600$, find the number of days for the number of micro-organisms in the two test tubes to be the same.

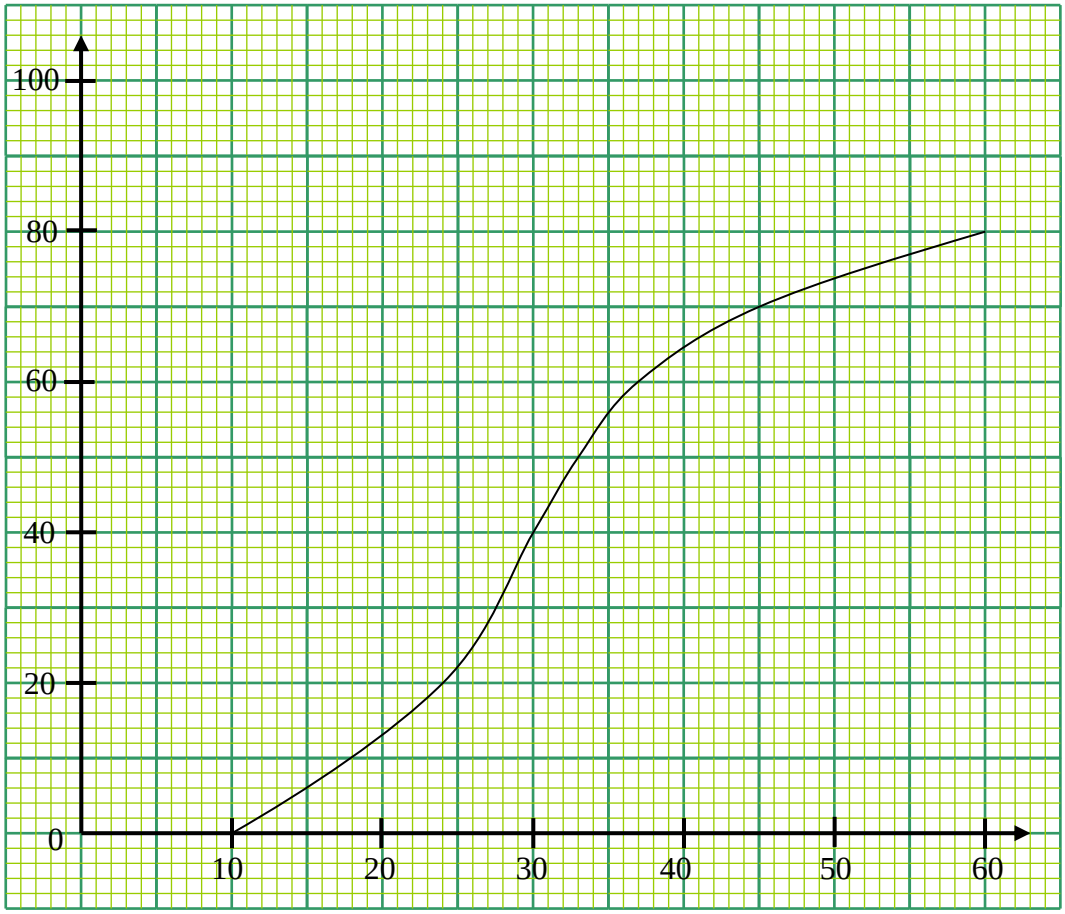
Answer $t =$ _____days [2]

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4 **(a)** The cumulative frequency curve shows the distribution of the scores of a Geography test (Test 1) taken by 80 students. Test 1 was marked out of 60.



(i) Use the curve to estimate

(a) the 40th percentile for Test 1,

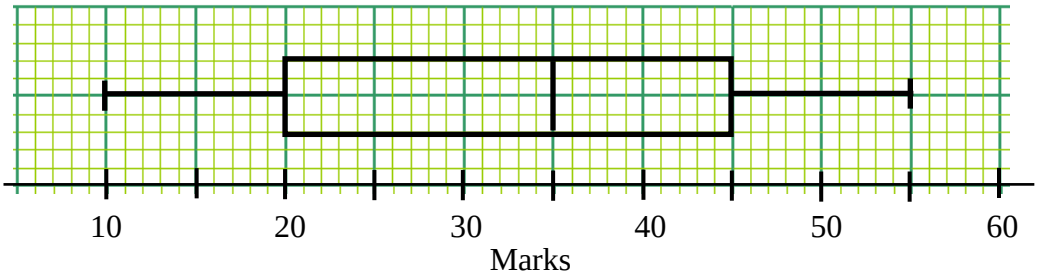
*Answer*_____ [1]

(b) the interquartile range for Test 1.

Answer _____ [2]

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(ii) This box-and-whisker plot represents the distribution of the scores of the same group of students for another Geography test (Test 2). Test 2 was marked out of 60.



Find the median mark for Test 2.

Answer _____ [1]

(iii) To obtain a distinction for Test 1 and Test 2, a student needs to score at least x marks.
If 12.5% of the students scored distinction for Test 1, find x.

Answer x = _____ [2]

(iv) "There is a higher proportion of students who scored distinction for Test 1."
Do you agree with this statement? Give a reason for your answer.

Answer

_____

_____

_____ [1]

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(b) The table below summarises the speeds of 95 cars on a stretch of road.

Speed (x km/h)	$35 < x \leq 45$	$45 < x \leq 55$	$55 < x \leq 65$	$65 < x \leq 75$	$75 < x \leq 85$
Number of cars	13	29	40	8	5

Calculate an estimate of

(i) the mean speed,

Answer _____km/h [1]

(ii) the standard deviation.

Answer _____km/h [1]

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5 **(a)** In 2018, Ben earned a total of $56 000.
In 2019, he earned $4800 each month.
Calculate the percentage increase in his earnings from 2018 to 2019.

Answer _____% [2]

(b) A bank offers a savings account with a rate of compound interest of 1.6% per year.
Ben invests $25 000 in this account.
He leaves the money in the account for 5 years.
Calculate the total amount of interest he has earned after 5 years.
Give your answer correct to the nearest cent.

Answer $ _____ [3]

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(c) The exchange rate between Singapore dollars (S$) and pounds (£) is S$1 = £0.59.
The exchange rate between euros (€) and Sinapore dollars (S$) is €1 = S$1.56.
Ben is planning a trip to Europe and he finds these hotel prices on a website.

London Hotel	£160 per night
Berlin Hotel	€160 per night

(i) By comparing the exchange rates or otherwise, determine which hotel is more expensive and provide an explanation for your claim.

Answer

The hotel in _____is more expensive because

_____

_____

_____ [2]

(ii) Ben decides to book 3 nights in the hotel in London and 5 nights in the hotel in Berlin. He pays using his credit card.
The credit card company converts the prices to Singapore dollars and charges a fee of 3.35% for the currency conversion.
Calculate the total amount Ben pays for the two hotels, including the credit card fee.
Give your answer correct to the nearest dollar.

Answer S$ _____ [3]

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6 **(a)** A is the point $(3,4)$ and B is the point $(6,0)$.

(i) Find $\left|\overrightarrow{AB}\right|$.

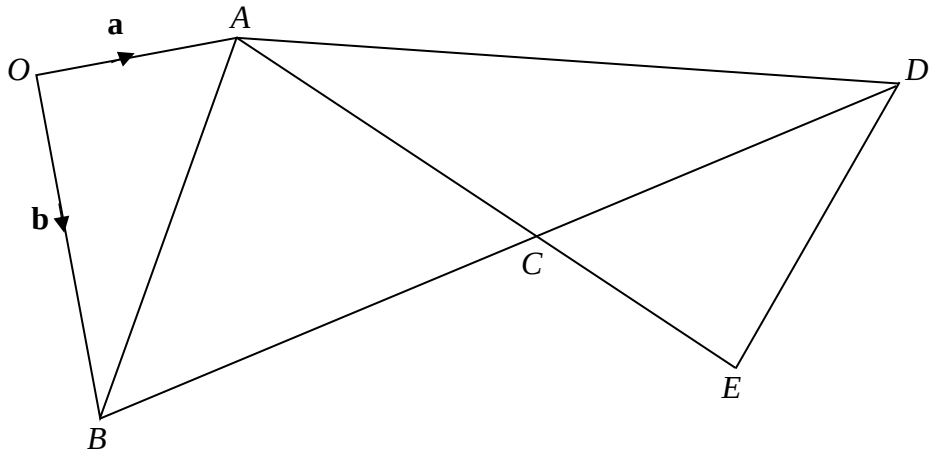
Answer _____ [2]

(ii) Find the value of k if $\overrightarrow{XY} = \begin{pmatrix} 9 \\ k \end{pmatrix}$ and XY is parallel to AB.

Answer $k =$_____ [2]

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(b)



In the diagram, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$. ACE is a straight line such that $\overrightarrow{AE} = 2\mathbf{a} + \mathbf{b}$. C is a point on AE such that $AC : CE = 3 : 2$.

(i) Express, as simply as possible, in terms of **a** and/or **b**,

(a) $\overrightarrow{BA}$,

Answer $\overrightarrow{BA} =$ _____ [1]

(b) $\overrightarrow{AC}$,

Answer $\overrightarrow{AC} =$ _____ [1]

(c) $\overrightarrow{BC}$.

Answer $\overrightarrow{BC} =$ _____ [2]

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It is given that $\overrightarrow{CD} = \frac{22}{15}\mathbf{a} - \frac{4}{15}\mathbf{b}$.

(ii) State two facts about the points *B*, *C* and *D*.

_____

_____

_____ [2]

(iii) What can you deduce about triangle *ABC* and triangle *EDC*?

_____

_____ [1]

(iv) Find $\frac{\text{area of triangle } ABC}{\text{area of triangle } ADC}$.

Answer _____ [2]

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7 Tap *A*, when turned on alone, will need *x* hours to fill up a swimming pool.
Tap *B*, when turned on alone, will fill the pool 4 hours earlier than Tap *A*.

(a) Write down, in terms of *x*,

(i) the fraction of the pool filled by Tap *A* alone in an hour.

Answer _____ [1]

(ii) the fraction of the pool filled by Tap *B* alone in an hour.

Answer _____ [1]

(b) Tap *A* and Tap *B* can fill up the swimming pool in 6 hours if they are both turned on together.
Form an equation in *x* and show that it reduces to $x^2 - 16x + 24 = 0$.

Answer

[3]

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(c) **(i)** Solve $x^2 - 16x + 24 = 0$.
Give your solutions correct to 2 decimal places.

Answer $x =$ _____ or $x =$ _____ [4]

(ii) Briefly explain why one of the answers cannot be accepted.

_____

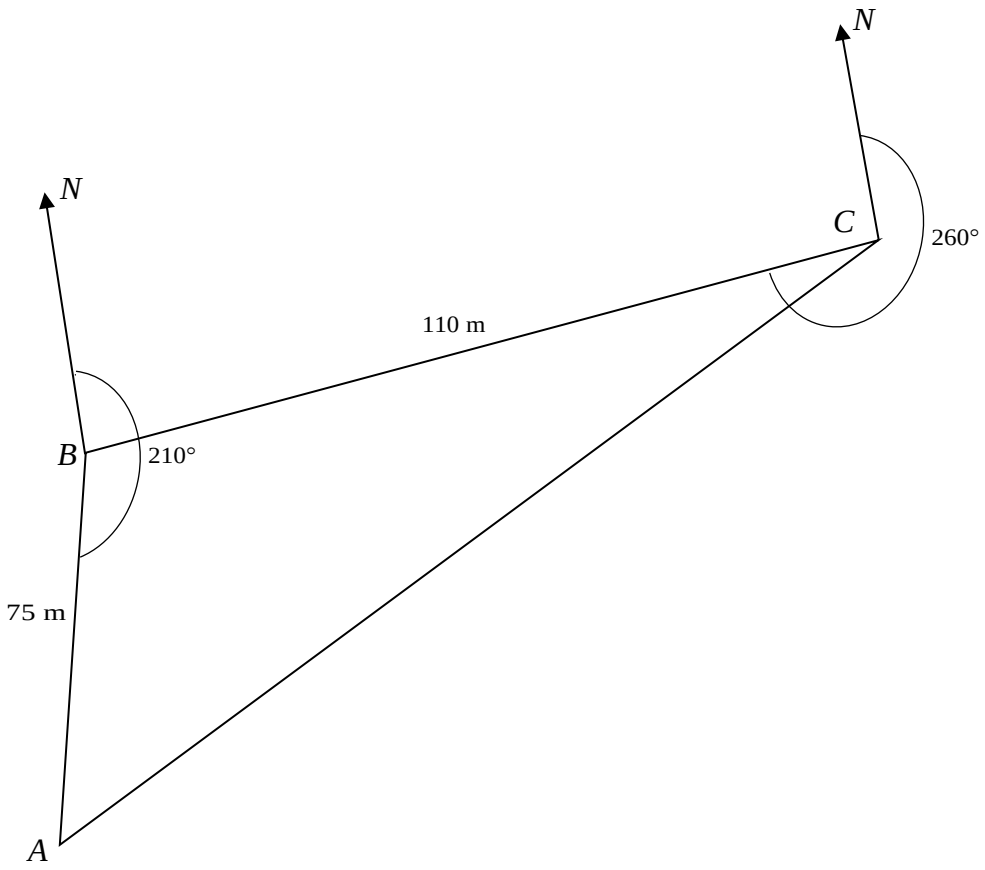
_____ [1]

(d) Find the time taken by Tap *B* to fill the pool alone, giving your answers in hours and minutes to the nearest minute.

Answer _____hours_____minutes [2]

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8 The diagram below shows 3 points, *A*, *B* and *C* on a level ground.
The bearing of *A* from *B* and *B* from *C* are $210°$ and $260°$ respectively.
AB = 75 m and *BC* = 110 m.



(a) Show that angle $ABC = 130°$. [2]

Answer

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(b) Find

(i) the distance *AC*,

Answer $AC =$ _____m [3]

(ii) the bearing of *C* from *A*.

Answer _____° [3]

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(c) A kite was seen flying 55 m vertically above point *B*. Find the greatest angle of elevation of the kite observed by a person walking in a straight path from *A* to *C*.

Answer _____° [3]

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9 Owen did well for his school examinations and his mother decided to reward him with a smartphone. She is considering mobile plans from 2 local service providers, MoonHub and SingCom. The table below shows an overview of the 2 mobile plans.

	MoonHub	SingCom
	$42.90 (2-year plan)	$56.61(2-year plan)
Local SMS/MMS	Unlimited	Unlimited
Incoming Calls	Free	Free
Outgoing Local Calls	150 mins	200 mins
	Excess local call charges: 16.05 cents/min	Excess local call charges: 16.05 cents/min
Local Bundle Data	4 GB	4 GB
	Excess local data charges: $10.70/GB	Excess local data charges: $8.60/GB

Note: Excess local data usage is charged at up to 1 GB for each of the respective prices stated.

(a) The table below shows Owen's average mobile usage per month.

Outgoing Local Calls	180 mins
Local Data	5.5 GB

Which mobile plan would be more suitable for Owen?
Justify your answer with calculations.

_____

_____

_____ [5]

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(b) The contracts for Owen's mother's mobile plan and fibre broadband plan are both ending soon. She is currently deciding two options:

	SingCom	MoonHub
Mobile Plan	\$56.61 per month	\$42.90 per month
Fibre Broadband Plan	\$38.89 per month	\$39.90 per month

Furthermore, SingCom is offering her a discount of 15% on her total bill.
Assume that her mobile usage per month does not exceed any limit and Owen's mobile usage per month is as shown in **part (a).**
Given that all the three plans should be from the same provider, which service provider should she use?
Justify your answer with calculations.

Answer

_____

_____

_____ [4]

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