智行菩願

MANJUSRI SECONDARY SCHOOL
文 殊 中 學

2024 PRELIMINARY EXAMINATION

Name	Marking Scheme
Class	
Index Number	

MATHEMATICS
Secondary Four Normal (Academic) / NT SBB
Paper 1

4045/01
1 August 2024
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, register number and class 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 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 70.

For Examiner's Use	
Total	**/ 70**

Parent's / Guardian's Signature: ……..

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

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

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

Answer **all** the questions.

1 Write the following numbers in order of lengths, starting with the **largest**.

$$\frac{48}{1000}, \qquad 48, \qquad \frac{48}{10^4}, \qquad 48 \times 10^4$$

$\frac{48}{1000}$, 48, $\frac{48}{10^4}$, 48×10^4

0.048, 48, 0.0048, 480000

(3) (2) (4) (1)

Answer: 48×10^4, 48, $\frac{48}{1000}$, $\frac{48}{10^4}$ B2 (B1 for at least 2 in correct order)

Answer ……, ……, ……, …… [2]

largest

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2 By rounding each number to 1 significant figure, **estimate** the value of

$$\frac{0.87 \times 547}{0.498}.$$

Show your working.

$\frac{0.87 \times 547}{0.498} \approx \frac{0.9 \times 500}{0.5}$ M1 (At least 2 correct roundings)

$= 900$ A1

Answer …… [2]

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3 Find the largest integer x satisfying the inequality $-5x > 36$.

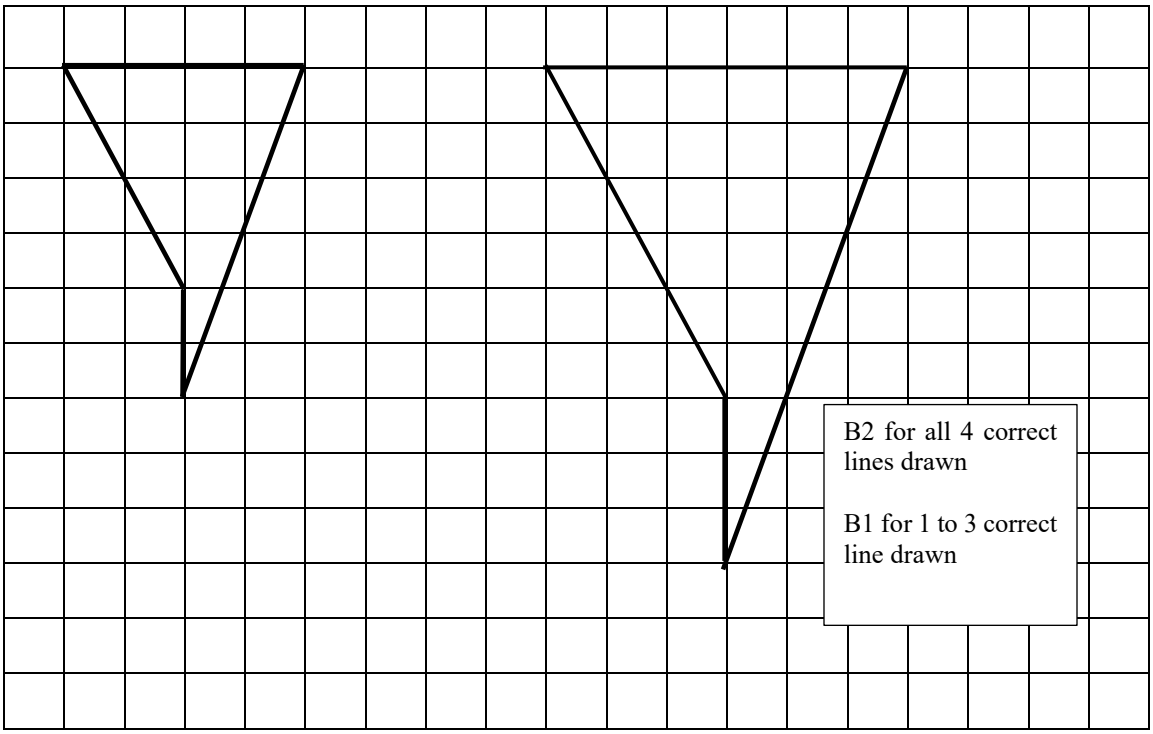
$x < \frac{36}{-5}$ M1

$x < -7.2$

Largest integer $= -8$ A1

Answer $x =$…… [2]

4



B2 for all 4 correct lines drawn

B1 for 1 to 3 correct line drawn

Draw an enlargement of this trapezium using a scale factor of 1.5. [2]

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5 The first five terms of a sequence are 9, 16, 23 and 30.

(a) Write down the next two terms in the sequence.

37, 44 B1

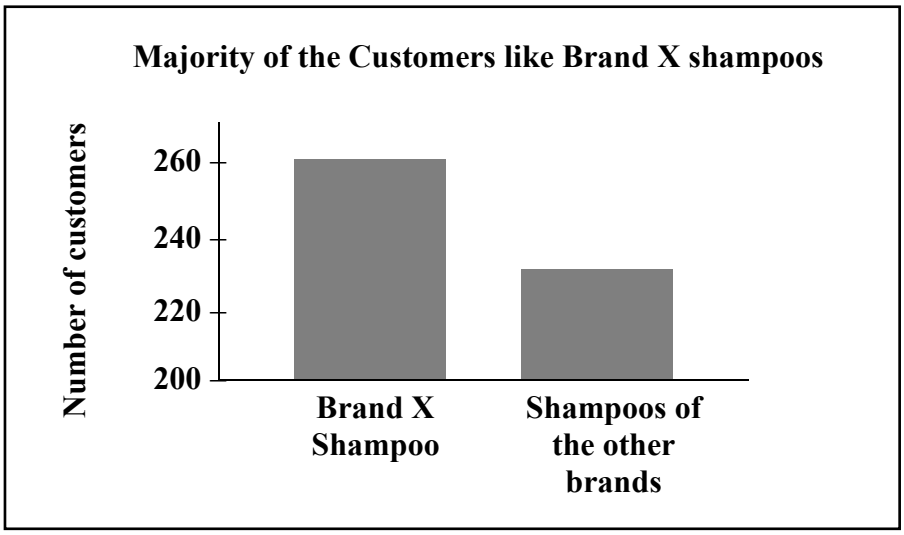
Answer ..... , ... [1]

(b) Find an expression for the nth term of the sequence.

$7n + 2$ B1

Answer ..... [1]

6



Bryan went to a supermarket to buy shampoo. He saw the above poster on a noticeboard and decided to buy Brand X shampoo as he saw that Brand X shampoo is twice as popular as the other brands.

Explain with calculations why Bryan was misled by the poster.

Answer ..

260 ÷ 230 = 1.13 , not 2 times. B1

The vertical axis did not start from zero, that enlarged the differences between the heights of the bars and gave misleading visual impact to the viewer. B1

….., ….,. [2]

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7 Given that $a = \dfrac{2b-1}{bc}$, make b the subject of the formula.

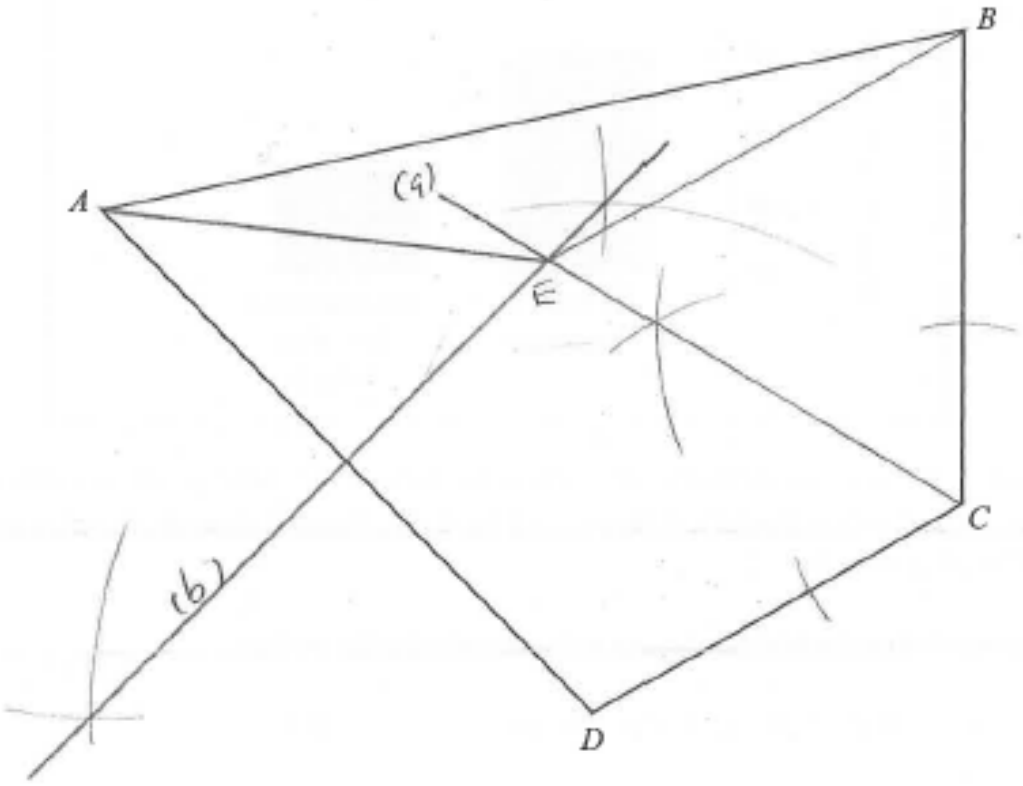
$abc = 2b - 1$ M1

$b(ac - 2) = -1$ M1

$b = \dfrac{-1}{ac-2}$ or $b = \dfrac{1}{2-ac}$ A1

Answer $b =$ ..... [3]

8



(a) Construct the angle bisector of angle *BCD*. [1]

(b) Construct the perpendicular bisector of *AD*. [1]

(c) *E* is the point of intersection of the bisector of angle *BCD* and the perpendicular bisector of *AD*. Measure the angle *AEB*.

Answer 145 ± 1 ° [1]

9 Rope *A* is 1.26 m and rope *B* is 84 cm.

(a) Find the ratio of the length of rope *A* to the length of rope *B*.

126 : 84 = 3 : 2 B1

Answer ……. : ……..... [1]

(b) Rope B is cut into three pieces in the ratio 2 : 3 : 5.
Find the difference in cm, between the lengths of the shortest and the longest piece.

10 units = 84 cm
1 unit = 8.4 cm M1
5-2 = 3 units = 8.4 cm × 3
= 25.2 cm A1

Answer ……. cm [2]

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10 Solve the following equation, giving your anwers correct to 2 decimal places.

$(x+5)(x-6)=9$

$x^2-x-30-9=0$ M1
$x^2-x-39=0$
$x=\dfrac{-(-1)\pm\sqrt{(-1)^2-4(1)(-39)}}{2(1)}$ M1
$x=\dfrac{1\pm\sqrt{157}}{2}$
$x=6.76$ or -5.76 (2 d.p.) A1

Answer $x=$……..... [3]

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11 Solve the following equations

(a) $5x-3=9$,

$5x=12$	
$x=2.4$	B1

Answer $x=$ …… [1]

(b) $\dfrac{3x+4}{4x-2}=\dfrac{1}{5}$.

$5(3x+4)=1(4x-2)$	M1
$15x+20=4x-2$	
$11x=22$	
$x=-2$	A1

Answer $x=$ ……..... [2]

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12 Factorise the following algebraic expressions completely

(a) $5wx+7wy-15xz-21yz$,

$=w(5x+7y)-3z(5x+7y)$	M1
$=(5x+7y)(w-3z)$	A1

Answer …….. [2]

(b) $5y^2-17y+6$.

$=(5y-2)(y-3)$	B2

Answer ……..... [2]

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13 The table below shows the tax rates on chargeable income for the year of assessment 2024.

Chargeable Income	Income Tax Rate (%)	Gross Tax Payable ($)
First $20,000 Next $10,000	0 2	0 200
First $30,000 Next $10,000	- 3.50	200 350
First $40,000 Next $40,000	- 7	550 2,800
First $80,000 Next $40,000	- 11.5	3,350 4,600
First $120,000 Next $40,000	- 15	7,950 6,000

Mr Fong's annual income was $113 400. He donated $100 to Community Chest and he was entitled to the personal relief of $16,000.

Chargeable income = annual income – donation – total personal relief.

Calculate

(a) Mr Fong's chargeable income.

Chargeable income = 113 400 – 100 – 16 000
= $ 97 300 B1

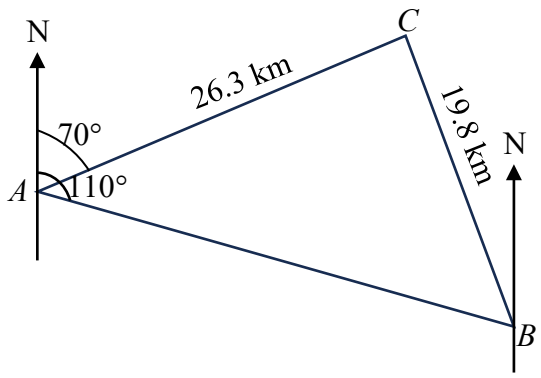
Answer $..... [1]

(b) the amount of personal income tax that he needed to pay.

Tax payable = $3350 + $17 300 × 11.5% M1
= $3350 + $1989.50
= $5339.50 A1

Answer $..... [2]

14



The diagram shows the position of 3 towns A, B and C. The bearing of B from A is 110° and the bearing of C from A is 070°. AC = 26.3 km and BC = 19.8 km.

Find

(a) angle ABC.

$\angle CAB = 110° - 70° = 40°$

$\dfrac{\sin \angle ABC}{26.3} = \dfrac{\sin 40°}{19.8}$ M1

$\sin \angle ABC = \dfrac{\sin 60°}{19.8} \times 26.3$

$\angle ABC = 58.628°$

$= 58.6°$ A1

Answer ……..…° [2]

(b) the bearing of C from B.

The bearing of C from B = 180° + 110 ° + 58.6° M1

= 348.6° (1 d.p.) A1

Answer ……..…° [2]

15 **(a)** Simplify $\left(\frac{3m^{-3}}{2n^{6}}\right)^{2} \times m^{0}$, expressing your answer in positive indices.

$\left(\frac{3m^{-3}}{2n^{6}}\right)^{2} \times m^{0} = \frac{3^{2}m^{-6}}{2^{2}n^{12}} \times 1$ M1 for at least 1 index law used correctly

$= \frac{9}{4m^{6}n^{12}}$ A1

Answer ……..…… [2]

(b) p is directly proportional to q^2.
If $q = 0.4$ when $p = 8$, find the value(s) of q when $p = 0.5$.

$p = kq^2$, where k is a constant.
Sub $q = 0.4$ and $p = 8$:
$8 = k \times 0.4^2$
$8 \div 0.4^2 = k$
$k = 50$ M1
When $p = 0.5$,
$0.5 = 50\, q^2$
$q = \pm\sqrt{\frac{0.5}{50}} = \pm 0.1$ A1 (A0 if negative answer is omitted)

Answer q = ……..…… [2]

16 **(i)** Express $x^2 - 12x - 10$ in the form of $(x+a)^2 + b$. Find the values of a and b.

$x^2 - 12x - 10$
$= x^2 - 12x + 6^2 - 6^2 - 10$ M1
$= (x-6)^2 - 46$
a = –6, b = –46 A1

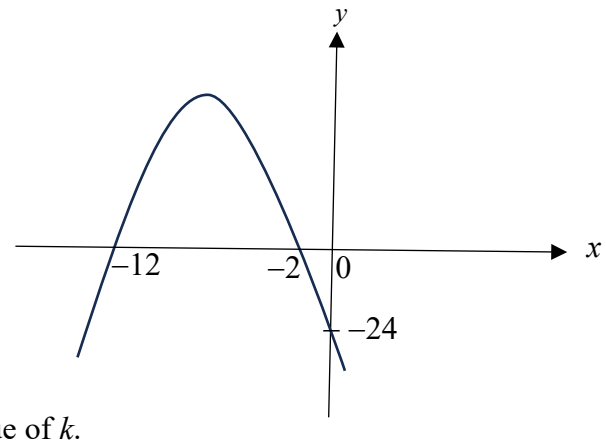
Answer $a = \ldots\ldots$, $b = \ldots\ldots$ [2]

(ii) Hence, solve $x^2 - 12x - 10 = 0$.

$x^2 - 12x - 10 = 0$
$(x-6)^2 - 46 = 0$
$x - 6 = \pm\sqrt{46}$ M1
$x = 6 \pm \sqrt{46}$
x = 12.8 or –0.782 (3 sf) A1

Answer $x = \ldots\ldots\ldots\ldots$ [2]

17 The sketch shows the quadratic curve of $y = k(x+2)(x+12)$.



(a) Find the value of k.

$-24 = k\,(2)(\,12)$	M1
$-24 = 24\,k$	
$k = -1$	A1

Answer $k =$ ……..… [2]

(b) Find the coordinates of the maximum point.

Line of symmetry: $x = \dfrac{(-12)+(-2)}{2} = -7$	M1
$y = -(-7+2)(-7+12) = 25$	
Max point = (−7, 25)	A1

Answer (…… , ……) [2]

18 The scale given on a particular map is 1 : 250 000.

(a) The length of Singapore river is 1.28 cm on a map.
Find the length of the actual length of Singapore river in km.

Map scale = 1 cm : 2.5 km	M1
Actual length of Singapore river	
= 2.5 km × 1.28	
= 3.2 km	A1

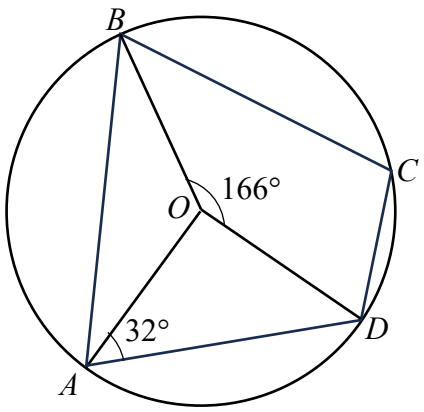
Answer …….. km [2]

(b) The area of Singapore is 734.3 km^2.
Calculate the area on the map in cm^2.

Area scale = $(1\ cm)^2 : (2.5\ km)^2$	M1
$= 1\ cm^2 : 6.25\ km^2$	
Map area of Singapore	
= 734.3 ÷ 6.25	
= 117.488 cm^2 (accept 117 cm^2)	A1

Answer ..... cm^2 [2]

19



Points A, B, C and D lie on a circle, centre O. $\angle OAD = 32°$ and $\angle BOD = 166°$.
Find the following angles, give reasons for your working.

(a) $\angle BOA$

$\angle BAD = 166° \div 2$ ($\angle$ at centre = 2×$\angle$ at circumference) M1

$= 83°$

$\angle BAO = 83° - 32° = 51°$

$\angle BOA = 180° - 51° \times 2 = 78°$ ($\angle$ sum of Δ) A1

Alternate method:

$\angle AOD = 180° - 2 \times 32°$ ($\angle$ sum of isosceles Δ) (M1)

$= 116°$

$\angle BOA = 360° - 116° - 166°$ ($\angle$s at a point) (A1)

Answer ……° [2]

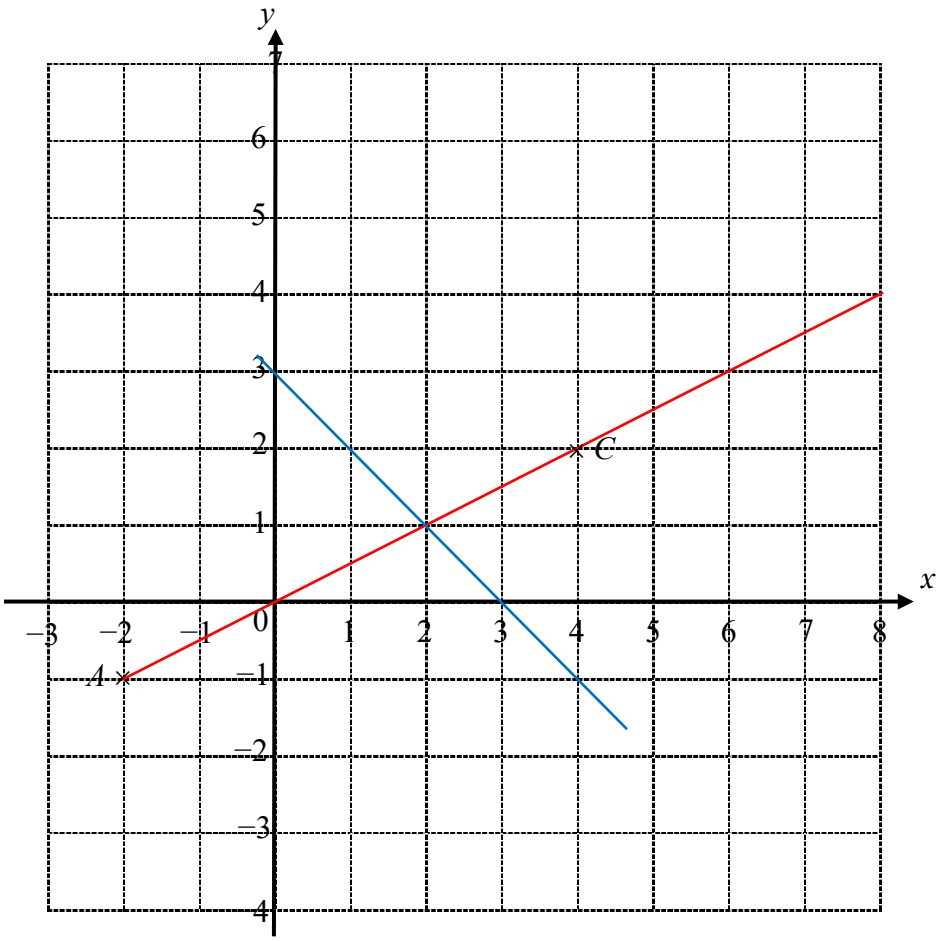
(b) $\angle BCD$

$\angle BCD = 180° - 83°$ ($\angle$ in opp segment) M1

$= 97°$ A1

Answer ……° [2]

20



On the above grid, A is the point $(-2, -1)$, B is the point $(6, k)$ and C is the point $(4, 2)$.

(a) Find the value of k if the gradient of the straight line joining A and B is $\frac{1}{2}$.

.

$k = 3$ B1

Answer $k =$..... [1]

(b) Write down the equation of the straight line joining A and B.

$y = \frac{1}{2}x$ B1

Answer ..... [1]

(c) Calculate the length of AC.

$AC = \sqrt{(-2-4)^2 + (-1-2)^2}$ M1

$= \sqrt{45}$

$= 6.71$ units A1

Answer ..... [2]

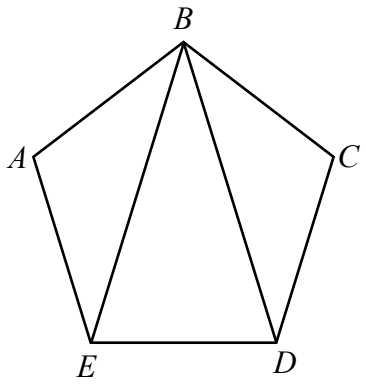
(d) On the grid above, draw the graph of $x + y = 3$. [1]

(e) From your graph, state the intersection point of the line AB and $x + y = 3$.

(2, 1) B1

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

21



ABCDE is a regular pentagon.

(a) Prove that ΔABE is congruent to ΔCBD.

Answer

$AB = BC$, $AE = CD$ (sides of a regular pentagon) M1

$\angle BAE = \angle BCD$ (angles of regular pentagon) M1

$\therefore \Delta ABE$ is congruent to ΔCBD (SAS) A1

[3]

(b) Calculate

(i) $\angle BAE$,

$$\angle BAE = \frac{(5-2)\times 180°}{5} = 108° \qquad \text{B1}$$

Answer ……° [1]

(ii) $\angle EBD$.

$\angle ABE = (180–108)° \div 2$ (base angles of isosceles Δ) M1

$= 36°$

$= \angle CBD$

$\angle EBD = 108° - 36° \times 2$

$= 36°$ A1

Answer ……° [2]

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