



MATHEMATICS PAPER 1 MARKING SCHEME

1. $(m^2 + 2mn + n^2) - p^2$ **M1** Factorising the first bracket
 $(m + n)^2 - p^2$ **M1** Factorising difference of perfect square
 $(m + n - p)(m + n + p)$ **M1** Correct factors
A 1 Accuracy **(4marks)**

2. **Question 2**

$$\frac{1}{\sqrt{8}} - \frac{1}{\sqrt{18}} \quad \textbf{M 1} \text{ rationalising each fraction}$$

$$\frac{\sqrt{8}}{8} - \frac{\sqrt{18}}{18}$$

$$\frac{9\sqrt{8} - 4\sqrt{18}}{72} \quad \textbf{M1} \text{ finding common denominator}$$

$$\frac{9 \times 2\sqrt{2} - 4 \times 3\sqrt{2}}{72} \quad \textbf{M1} \text{ simplifying the numerator}$$

$$\frac{18\sqrt{2} - 12\sqrt{2}}{72} \quad \textbf{M1} \text{ for subtracting surds}$$

$$\frac{6\sqrt{2}}{72}$$

$$\frac{\sqrt{2}}{12} \quad \textbf{A1} \text{ for accuracy}$$

OR

$$\frac{1}{2\sqrt{2}} - \frac{1}{3\sqrt{2}}$$

$$\frac{2\sqrt{2}}{8} - \frac{3\sqrt{2}}{18}$$

$$\frac{\sqrt{2}}{4} - \frac{\sqrt{2}}{6}$$

$$\frac{3\sqrt{2}-2\sqrt{2}}{12}$$

$$\frac{\sqrt{2}}{12}$$

3

$$S_{n=2n^2+9n}$$

$$S_1=2(1)^2+9(1)$$

a = 11.....M1 finding first term

$$S_{2=2^2+9(2)}$$

=8+18.....M1.Finding sum first and second term

$$a+a+d=26.....$$

11+11+d=26..... M1 finding common difference.

$$d=26-22$$

$$d=4$$

a+d = 11 + 4 = 15.....M1 finding second and third term

$$a+d+d=11 + 4 + 4 = 19.....$$

: Three terms = 11, 15, 19 (5marks)

Question 4

$$M = \frac{VP^2}{C-P^2}$$

$$\frac{M}{1} = \frac{VP^2}{C-P^2} \quad \text{M1 clear fraction}$$

$$VP^2 = M(C-P^2) \quad \text{M1 multiplying RHS}$$

$$VP^2 = MC - MP^2 \quad \text{M1 collecting terms with P together}$$

$$VP^2 + MP^2 = MC \quad \text{M1 square rooting both sides}$$

$$P^2 = \frac{MC}{V+M}$$

$$P = \sqrt{\frac{MC}{V+M}} \quad \text{A1 for accuracy}$$

Question 5

$$f(x) = 5x + 4$$

$$f(a) = 19$$

$$f(a) = 5a + 4 \quad \text{M1 for substitution}$$

$$19 = 5a + 4$$

$$19 - 4 = 5a$$

$$15 = 5a$$

$$a = 3 \quad \text{A1 for accuracy}$$

$$f(x) = 5x + 4$$

$$f(-1) = 5(-1) + 4 \quad \text{M1 for substitution}$$

$$f(-1) = b$$

$$b = -5 + 4$$

$$= -1 \quad \text{A1 for accuracy}$$

Question number 6.

$$AB = \frac{\sqrt{(2 - 2)^2 + (2 - 2)^2}}{\sqrt{4^2 + 3^2}} \quad \text{M1 Finding AB}$$

$$= \sqrt{25}$$

$$= 5 \text{ Units}$$

$$BC = \frac{\sqrt{(-2 - 2)^2 + (-1 - 1)^2}}{\sqrt{4^2 + 3^2}} \quad \text{M1 Finding AC}$$

$$= \sqrt{9}$$

$$= 3 \text{ Units}$$

$$AC^2 + BC^2 = AB^2 \quad \text{Pythagoras Theorem M1 using py to identify right angle}$$

$$3^2 + 4^2 = 5^2$$

$$9 + 16 = 25$$

$$25 = 25$$

Right angle is at point C (2, -1) A1 Accuracy (5marks)

Question 7

Join EC M1 for construction C = OE radii M1 For the reason AEF =

A C E $56^\circ 24$ M1 Angle of alternate segments

OCE = OEC = $\frac{48}{2}$ = base angles of ISO triangle

ACO = $56 - 24 = 32$ A1 accuracy (4marks)

Question 8

$$(x - 5)(x - 3)(x - 3) \equiv Px^3 + Qx^2 + Rx + K$$

$$(x-5)(x^2-6x+9) \equiv Px^3+Qx^2+Rx+K$$

M1 expanding LHS

$$x^3-6x^2+9x-5x^2-30x-45 \equiv Px^3+Qx^2+Rx+K$$

$$x^3-11x^2+39x-45 \equiv Px^3+Qx^2+Rx+K$$

M1 simplifying

$$-11x^2 = Qx^2$$

M1 equating corresponding term

$$-\frac{11x^2}{x^2} = \frac{Qx^2}{x^2}$$

$$Q = -11$$

A1 for accuracy

Question 9

$$\text{Height for Ireen} = 1.2x$$

M1 relating ages of the two

$$\text{Height for Shyreen} = x$$

$$Sf = \frac{1.2x}{x} = \frac{1.2}{1}$$

M1 finding S.F

$$Af = \left(\frac{1.2}{1}\right)^2 = \frac{1.44}{1}$$

M1 finding A.F

Let y be amount of money Ireen would spend

$$\frac{y}{15000} = \frac{1.44}{1} \text{ M1 for simplification}$$

$$y = 1.44 \times 15000$$

$$y = \text{K } 21,600.00$$

A1 for accuracy

Question 10

$$\text{Translation vector} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$$

M1

$$A' = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 3 \\ -5 \end{pmatrix} = \begin{pmatrix} 4 \\ -3 \end{pmatrix} \Rightarrow (4, -3) \text{ M1}$$

$$B' = \begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 3 \\ -5 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \end{pmatrix} \Rightarrow (1, -2) \text{ M2}$$

$$C' = \begin{pmatrix} -2 \\ 4 \end{pmatrix} + \begin{pmatrix} 3 \\ -5 \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \Rightarrow (1, -1) \text{ A1}$$

(5 marks for finding image of each point)

Question 11

Method 1

$$x^2 - 4x + 3 = 0$$

$$\begin{aligned}
 x^2 - 4x &= -3 & \text{M1 completing square} \\
 x^2 - 4x + 4 &= +4 - 3 & \text{M1 factorising LHS and simplifying} \\
 (x-2)^2 &= 1 & \text{RHS} \\
 (x-2)^2 - 1 &= 0 & \text{M1 Finding coordinates} \\
 x-2=0 & \quad x=2 \\
 \text{Turning point coordinates} &= (2, -1) & \text{A1 accuracy} \quad \textbf{(4marks)}
 \end{aligned}$$

$$\begin{aligned}
 & \left(\frac{-b}{2a} - \frac{-b^2+4ac}{4a} \right) & \text{Method 2 using the formula} & x^2 \\
 & & & -4x+3 \\
 \text{Turning Point} &= \left(\frac{-(-4)}{2(1)} - \frac{-(-4)^2+4(1)(3)}{4(1)} \right)
 \end{aligned}$$

$$\begin{aligned}
 & \text{M1 identifying a,b and c} \\
 & a = 1 \quad b = -4 \quad c = 3 \\
 & = \left(\frac{4}{2}, \quad \frac{-4}{4} \right) & \text{M1 Substituting in the formula} \\
 & (2, -1) & \text{M1 Simplifying} \\
 & & \text{M1 Finding the coordinates}
 \end{aligned}$$

A1 Accuracy **(5marks)**

Question 12

$$\begin{pmatrix} 3 & 3 \\ -1 & -1 \end{pmatrix} \begin{pmatrix} 3 & 3 \\ -1 & -1 \end{pmatrix} = a \begin{pmatrix} 3 & 3 \\ -1 & -1 \end{pmatrix} \quad \text{M1 correct substitution}$$

$$\begin{aligned}
 3 \times 3 + 3 \times -1 &= 3a & \text{M1 row by column multiplication} \\
 & & \text{M1 multiplication of scalar by matrix} \\
 9 - 3 &= 3a & \text{M1 correct equation to get value} \\
 a &= 3 & \text{A1 accuracy}
 \end{aligned}$$

QUESTION 13

$$a = 2, b = -8 \text{ and } c = -7$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

M1 for correct substitution

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(2)(-7)}}{2(2)}$$

$$x = \frac{8 \pm \sqrt{64 - (-56)}}{4}$$

M1 for simplification

$$x = \frac{8 \pm \sqrt{64 + 56}}{4}$$

$$x = \frac{8 \pm \sqrt{120}}{4}$$

M1 for finding square root

$$x = \frac{8 \pm 10.9544512}{4}$$

$$\frac{8 + 10.9544512}{4} \vee \frac{8 - 10.9544512}{4}$$

$$= 4.7386128 \text{ or } -0.7386128$$

$$x = 4.74 \quad \text{or } -0.74$$

A2 for accuracy

Question 14

$$\frac{\sin 60^\circ \tan 45^\circ}{\tan 30^\circ \cos 30^\circ} = \frac{\frac{\sqrt{3}}{2} \times 1}{\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{2}}$$

M1 identifying special angles

$$= \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}}$$

M1 for simplification

$$= \frac{\sqrt{3}}{2} \times \frac{2}{1}$$

M1 for upsetting the divisors

$$= \sqrt{3}$$

A1 for accuracy

Question 15

$$\frac{1}{2} \times 5 \times 6 \sin B = 12 \quad \text{M1 equating to sine area rule}$$

$$15 \sin B = 12 \quad \text{M1 substituting correctly}$$

$$B = \sin^{-1}\left(\frac{12}{15}\right) \quad \text{M1 for simplification}$$

$$B = 53.1130 \quad \text{M1 finding correct angle B}$$

$$B = 53 \quad \text{A1 for accuracy}$$

QUESTION 16

$$\frac{\sqrt{2} x \sqrt{2} x \sqrt{3} x \sqrt{25} x \sqrt{36} x \sqrt{3}}{9x\sqrt{2} x x \sqrt{3}} \quad \text{M1 factorising the numerators}$$

$$\frac{2 \times 3 \times 5 \times 6}{9\sqrt{6}} \quad \text{M1 factorising the denominator}$$

$$\frac{180}{9\sqrt{6}} \quad \text{M1 dividing by the numerator}$$

$$= \frac{20}{\sqrt{6}} \quad \text{M1 simplifying}$$

A1 accuracy

Question 17

$$M = \frac{kh}{r^2}$$

M1 writing joint variation

$$500 = \frac{50k}{2^2}$$

M1 for substitution

$$500 = \frac{50k}{4}$$

M1 simplification to find constant

$$2000 = 50k$$

$$k = 40$$

$$M = \frac{40h}{r^2}$$

M1 substituting k into law

$$M = \frac{40(10)}{4^2}$$

M1 simplification

$$M = \frac{400}{16}$$

$$M = 25g$$

A1 Accuracy

Question 18

$$2800l = 2\,800\,000\text{cm}^3$$

$$1.4m = 140cm$$

M1 changing litres to cubic centimeter

$$V = \pi r^2 h$$

$$2\,800\,000 = \frac{22}{7} \times 140 \times 140 \times h$$

M1 finding height

$$19\,600\,000 = 431\,200h$$

M1 equating the volumes

$$h = \frac{19600000}{431200}$$

M1 substitution

$$h = 45.4545455$$

$$h = 45.5cm$$

Height of water remaining

$$45.5 - 40 = 5.5cm$$

$$V = \pi r^2 h$$

$$\text{Volume} = \frac{22}{7} \times 140 \times 140 \times 5.5$$

M1 for substitution

$$= \frac{2371600}{7}$$

$$= 338\,800\text{cm}^3$$

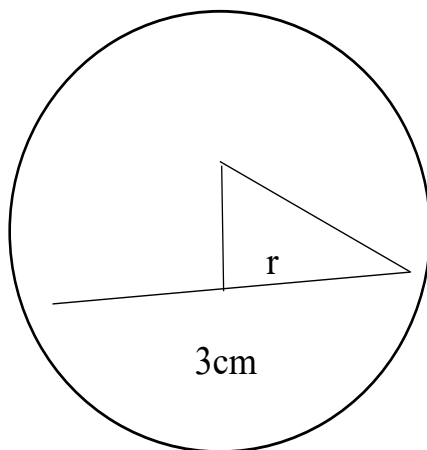
$$11 = 1000\text{cm}^3$$

$$= \frac{338800}{1000}$$

$$= 338.8\text{l left in the tank}$$

A1 for accuracy

Question 19



$$r^2 = 3^2 + 4^2 \quad \text{M1 substitution into correct Pythagoras theorem}$$

$$= 9 + 16 \quad \text{M1 simplification}$$

$$= 25 \quad \text{M1 finding square of } r$$

$$r = \sqrt{25} \quad \text{M1 for square rooting}$$

$$= 5\text{cm} \quad \text{A1 accuracy}$$

The radius is 5cm long

Question 20

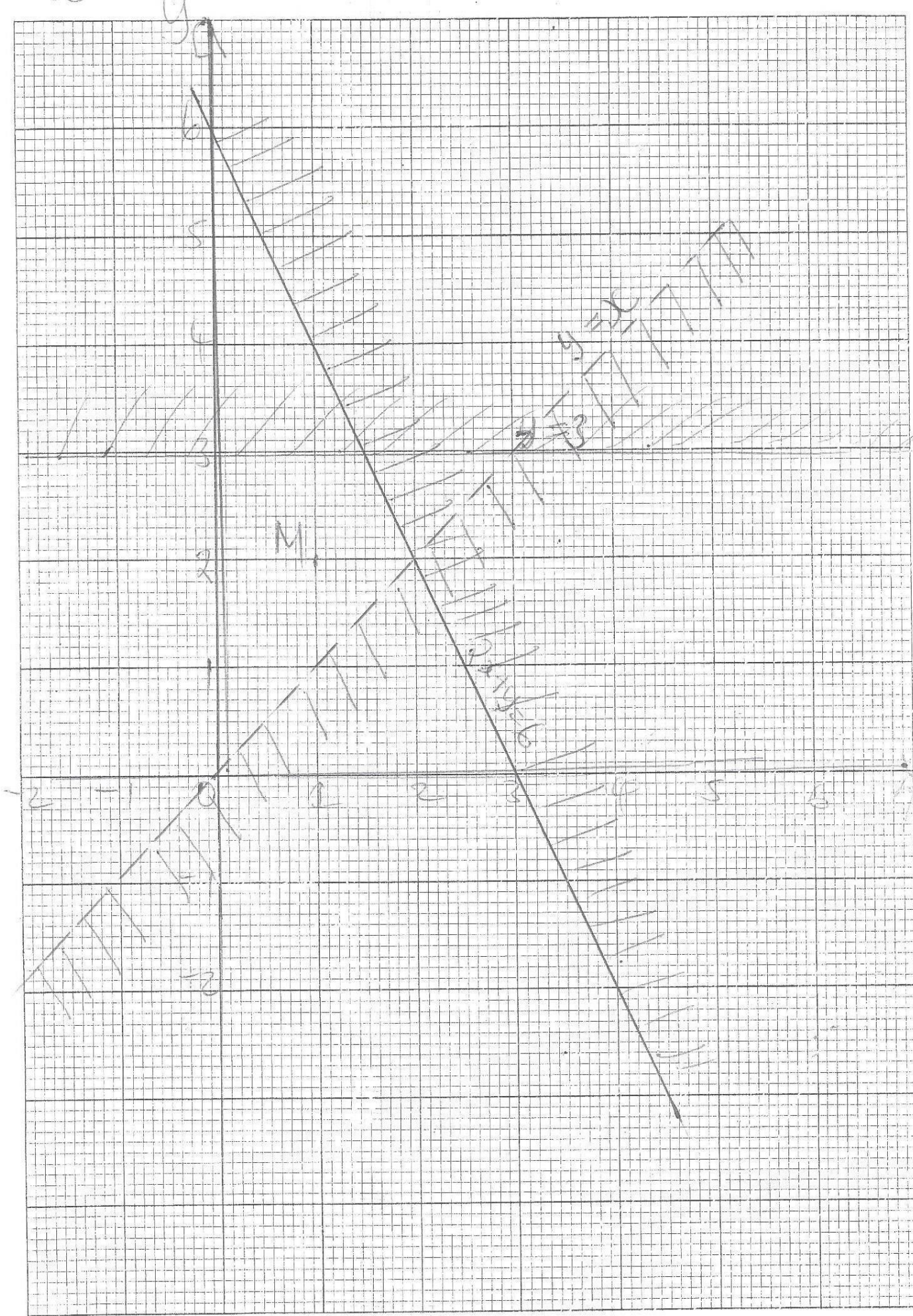
M1 for shading correct unwanted region of $2x + y \leq 6$

M1 for shading correct unwanted region of $y > x$

M1 shading correct unwanted region of $y \leq 3$

M1 drawing correct lines

A1 for accuracy





$$x - t = 0$$

$$x = t$$

M1 equating x to t

M1 Substituting in the polynomials

$$t^3 - t^2 + t + 9 = t^3 - 4t + 3$$

M1 equating to zero

$$0 = t^2 - 5t - 6$$

M1 Factorising

$$0 = (t - 6)(t + 1)$$

M1 Finding t t - 6

$$= 0 \quad t + 1 = 0 \quad t = 6 \quad t = -1$$

$$t = -1 \text{ or } 6 \text{ Accuracy}$$

A1

(7marks)

9.

$$\frac{\triangle ABC}{\triangle ADE} = \frac{BC}{DE} = \frac{6}{x}$$

M1 Proportion of sides

M1 Equating sides to area ration

M1 Squaring sides to equate to area ratio

$$\frac{6^2}{x^2} = \frac{2}{5} \quad \text{M1 Finding the value of x}$$

$$\frac{2x^2}{2} = \frac{180}{2}$$

$$x^2 = 90$$

$$x^2 = 90$$

$$x = \sqrt{90}$$

value of x 9.4868

B1 A1 Correcting to 1 decimal place and Accuracy

(6marks)

$$\frac{\sqrt{2} x \sqrt{2} x \sqrt{3} x \sqrt{25} x \sqrt{36} x \sqrt{3}}{9x\sqrt{2} x x \sqrt{3}}$$

M1 Factorising the numerators

M1 Factorising the denominators

M1 dividing by common factors

M1 Simplifying the numerator and denominator

A1 Accuracy

$$\frac{\sqrt{2} x^3 x^5 x^6^2}{9}$$

$$10\sqrt{2}$$

17.

Class	Frequency
3-7	2
8-12	5
13-17	3
18-22	7

M1 correct rows and column

M1 correct classes

M1 correct frequency

A1 Accuracy

$$\sum f = 2 + 5 + 3 + 1$$

M1 Adding frequency

$$= 11 \text{ passengers}$$

(6marks)

$$\begin{pmatrix} 3 & 3 \\ -1 & -1 \end{pmatrix} \begin{pmatrix} 3 & 3 \\ -1 & -1 \end{pmatrix} = a \begin{pmatrix} 3 & 3 \\ -1 & -1 \end{pmatrix}$$

18. **M1** Correct substitution

$$3 \times 3 + 3 \times -1 = 3 \times a$$

M1 row by column multiplication

M1 Multiplication of scalar by matrix

$$9 - 3 = 3a$$

M1 correct equation to get value

$$\frac{6}{3} = \frac{3a}{3}$$

$$a = 2$$

A1 accuracy



19. $\frac{1}{2} \times 5 \times 6 \sin B = 12$

$15 \sin B = 12$

$B = \sin^{-1}\left(\frac{12}{15}\right)$

$B = 53.1130$

53°

M1 equating to sine area rule

M1 substituting correctly

M1 simplify correctly

M1 finding angle B correct to the nearest

M1 Accuracy degree **(5marks)**

20 **M1** Shading correct unwanted region of $2x + y \leq 6$

M1 Shading correct unwanted region of $y > x$

M1 Shading correct unwanted region of $y \leq 3$

A1 Accuracy

(4marks)

20.

