



MARKSCHEME

May 1999

MATHEMATICAL STUDIES

Standard Level

Paper 1

1. (a) 471.03 (A1)
(b) (i) 471 (A1)
(ii) 4.71×10^2 or 4.71028×10^2 or 4.7103×10^2 (A1)(A1)

Answers: (a) 471.03 (C1)
(b) (i) 471 (C1)
(ii) 4.71×10^2 or 4.71028×10^2 or 4.7103×10^2 (C2)

2. (a) $2J + 3C = 5.95$ (A2)
(b) $2 \times 2.15 + 3C = 5.95$ (M1)
 $3C = 1.65$
 $C = 0.55$ (A1)

Answer: (a) $2J + 3C = 5.95$ (C2)
(b) 55 (pence) or £0.55 (C2)

3. (a) $5.5 = \frac{4+3+a+8+7+3+9+5+8+3}{10}$ (M1)
 $55 = 50 + a$
 $5 = a$ (A1)
(b) 3, 3, 3, 4, 5, 5, 7, 8, 8, 9 (M1)
Median = 5 (A1)

Note: Award (M1) for arranging scores in ascending or descending order. Follow through with candidate's a

Answers: (a) $a = 5$ (C2)
(b) 5 (C2)

4. (a) $2 \times \begin{pmatrix} 2 & 1 \\ -3 & 2 \end{pmatrix} = \begin{pmatrix} 4 & 2 \\ -6 & 4 \end{pmatrix}$ (A1)

(b) $\begin{pmatrix} 2 & 1 \\ -3 & 2 \end{pmatrix} + \begin{pmatrix} -3 & 4 \\ 3 & 0 \end{pmatrix} = \begin{pmatrix} -1 & 5 \\ 0 & 2 \end{pmatrix}$ (A1)

Note: In parts (a) and (b), all 4 elements must be correct for (A1)

(c) $\begin{pmatrix} 2 & 1 \\ -3 & 2 \end{pmatrix} \times \begin{pmatrix} -3 & 4 \\ 3 & 0 \end{pmatrix} = \begin{pmatrix} -3 & 8 \\ 15 & -12 \end{pmatrix}$ (A2)

Notes: Award $\frac{1}{2}$ mark for each element, and round down.
Award (M1) for correctly calculating BA.

Answers: (a) $\begin{pmatrix} 4 & 2 \\ -6 & 4 \end{pmatrix}$ (C1)

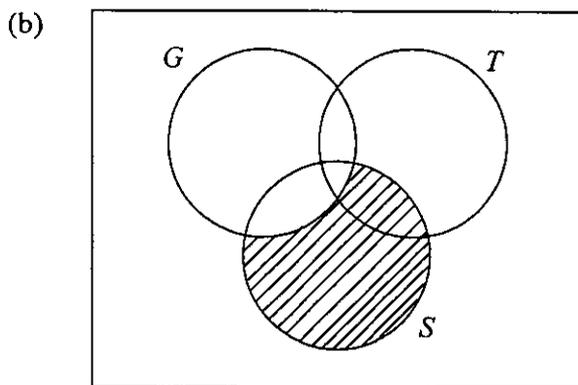
(b) $\begin{pmatrix} -1 & 5 \\ 0 & 2 \end{pmatrix}$ (C1)

(c) $\begin{pmatrix} -3 & 8 \\ 15 & -12 \end{pmatrix}$ (C2)

5. (a) (i) 11 (A1)

(ii) $2 + 3 = 5$ (A1)

(iii) $8 + 4 + 6 + 4 = 22$ (A1)



(A1)

Answers: (a) (i) 11 (C1)

(ii) 5 (C1)

(iii) 22 (C1)

(b) See diagram (C1)

6. (a) gradient = $\frac{-4}{3}$ or -1.33 (3 s.f.) (A1)

(b) $y = \frac{-4}{3}x + 4$ (A1)

OR $4x + 3y - 12 = 0$

OR equivalent form

Note: The y-intercept must be 4, allow follow through from part (a)

(c) $y = \frac{-4}{3}x - 4$ (M1)

Note: Award (M1) for y-intercept as -4

$4x + 3y + 12 = 0$ or $\frac{4}{3}x + y + 4 = 0$ (A1)

Answers: (a) $\frac{-4}{3}$ or -1.33 (3 s.f.) (C1)

(b) $y = \frac{-4}{3}x + 4$ or $4x + 3y - 12 = 0$ (C1)

(c) $4x + 3y + 12 = 0$ or $\frac{4}{3}x + y + 4 = 0$ (C2)

7. (a) $a = 100$ $d = 25$

$$T_{17} = 100 + (17 - 1) \times 25 \quad (M1)$$

$$= 500 \quad (A1)$$

(b) $S_n = \frac{n}{2}(a + l)$

$$S_{17} = \frac{17}{2}(100 + 500) \quad (M1)$$

$$= 5100 \quad (A1)$$

Note: Allow follow through from candidate's answer for T_{17} , which is l

OR

$$S_n = \frac{n}{2}\{2a + (n - 1)d\}$$

$$S_{17} = \frac{17}{2}\{2 \times 100 + (17 - 1) \times 25\} \quad (M1)$$

$$= 5100 \quad (A1)$$

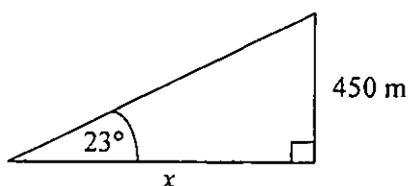
OR

Table

Answers: (a) \$ 500 (C2)

(b) \$ 5100 (C2)

8. (a)



(M1)

Note: All three (23° , x , 450) must be labelled and in correct position for (M1)

(b) $\tan 23^\circ = \frac{450}{x}$

(M1)

Note: Follow through from candidate's diagram

$$x = \frac{450}{\tan 23^\circ}$$

(M1)

$$x = 1060.13\dots$$

$$x = 1060 \text{ (3 s.f.)}$$

(A1)

Answers: (a) See diagram

(C1)

(b) 1060

(C3)

9. (a) (i) 0.23

(A1)

(ii) $0.21 + 0.15 = 0.36$

(A1)

Note: Accept equivalent answers

(b) 1200×0.23
 $= 276$

(M1)

(A1)

Note: Follow through from candidate's answer in part (a)(i)

Answers: (a) (i) 0.23

(C1)

(ii) 0.36

(C1)

(b) 276

(C2)

10. (a) $g^{-1}(x) = x + 5$ or $y = x + 5$ (A1)
- (b) (i) $f(-3) = 2x - 3 + 3$
 $= -3$ (A1)
- (ii) $(f \circ g)(x) = 2(x - 5) + 3$ (M1)
 $= 2x - 7$
- $(f \circ g)(6) = 2 \times 6 - 7$
 $= 5$ (A1)

Note: Award (M1) for calculating $g(6) = 1$

- Answers:** (a) $g^{-1}(x) = x + 5$ (C1)
- (b) (i) -3 (C1)
- (ii) 5 (C2)

11. (a) $16.5 \leq \text{length} < 17.5$ (A1)(A1)
- (b) minimum area = 16.5×7.5 (M1)
 $= 123.75$ (A1)

Note: Award (M1) for 7.5

- Answers:** (a) $16.5 \leq \text{length} < 17.5$ (C2)
- (b) 123.75 (C2)

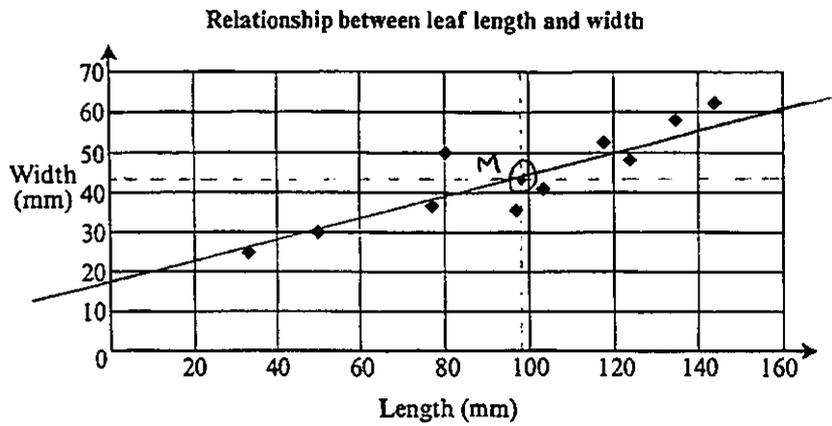
12. (a) $N = 150 \times 2^0 = 150$ (A1)
- (b) $N = 150 \times 2^3 = 1200$ (A1)
- (c) $19200 = 150 \times 2^t$ (M1)
- $128 = 2^t$
- $7 = t$ (A1)

- Answers:** (a) 150 (C1)
- (b) 1200 (C1)
- (c) 7 (C2)

13. (a) (see diagram)

(A1)

(b)



(A2)

Notes: (a) Award (A1) for the point *M*.
 (b) Award (A1) for a line of best fit going through *M* and (A1) for a reasonable line of best fit

(c) Leaf length and leaf width are positively correlated

(R1)

Answers: (a) See diagram

(C1)

(b) See diagram

(C2)

(c) Leaf length and leaf width are positively correlated

(C1)

14. $x \geq 0$

(A1)

$y > 1$

(A1)

$y \leq -\frac{1}{2}x + 4$

(A2)

Note: Accept equivalent forms e.g. $x + 2y \leq 8$, $4x + 8y \leq 32$

Answers: $x \geq 0$

(C1)

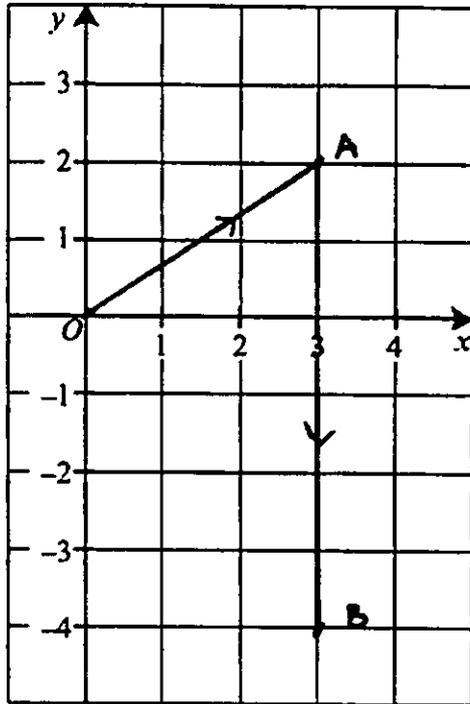
$y > 1$

(C1)

$y \leq -\frac{1}{2}x + 4$ or $x + 2y \leq 8$ or $4x + 8y \leq 32$

(C2)

15. (a)



(A2)

Notes: Award (A1) for correct \vec{OA} and (A1) for correct \vec{AB}
 If there are no arrows on the vectors award (A1) only for both correct

(b) length $\vec{OB} = \sqrt{3^2 + (-4)^2}$
 $= 5$

(M1)

(A1)

OR

$$\vec{OB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} 0 \\ -6 \end{pmatrix} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$$

(M1)

length $\vec{OB} = \sqrt{3^2 + (-4)^2}$
 $= 5$

(A1)

Answers: (a) See diagram

(C2)

(b) 5

(C2)

16. $A = C \left(1 + \frac{r}{100} \right)^n$

$$125 = 100 \left(1 + \frac{r}{100} \right)^2$$

(M1)

$$1.25 = \left(1 + \frac{r}{100} \right)^2$$

(M1)

$$1.11803398 - 1 = \frac{r}{100}$$

(M1)

$$r = 11.8\% \text{ (3 s.f.)}$$

(A1)

Answer: 11.8 %

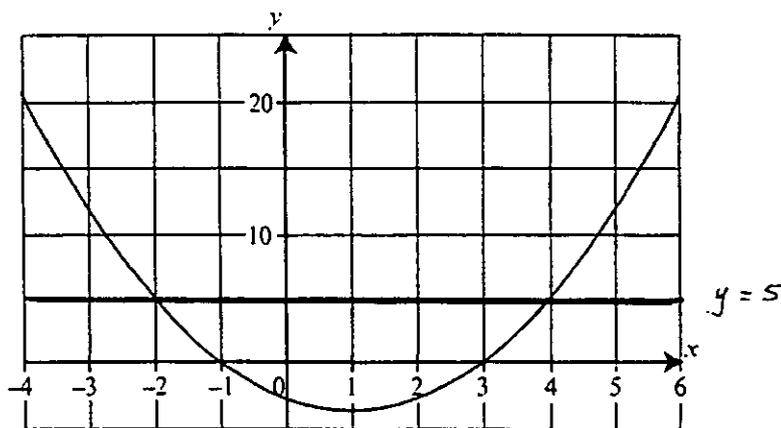
(C4)

17. (a) $\frac{3}{50}$ or 6 % or 0.06 (A1)
- (b) $\frac{45}{50}$ or $\frac{9}{10}$ or 90 % or 0.9 (A1)
- (c) $\frac{16}{18}$ or $\frac{8}{9}$ or 0.889 (3 s.f.) (A2)

Note: Award (A1) for 16 and (A1) for 18

- Answers: (a) $\frac{3}{50}$ or 6 % or 0.06 (C1)
- (b) $\frac{45}{50}$ or $\frac{9}{10}$ or 90 % or 0.9 (C1)
- (c) $\frac{16}{18}$ or $\frac{8}{9}$ or 0.889 (C2)

18. (a)



(A1)

Note: The equation $y = 5$ is not required

- (b) (i) $x = -2$ (A1)
 $x = 4$ (A1)
- (ii) $x = 1$ (A1)

Note: Allow follow through from candidate's graph

- Answers: (a) See graph (C1)
- (b) (i) -2, 4 (C2)
- (ii) 1 (C1)

19. (a) $C\hat{A}B = 180 - 2 \times 23^\circ$ (M1)
 $= 134^\circ$ (A1)
- (b) $\frac{AB}{\sin 23^\circ} = \frac{15}{\sin 134^\circ}$ (M1)

Note: Follow through with candidate's answer from (a)

$$AB = \frac{15 \sin 23^\circ}{\sin 134^\circ}$$

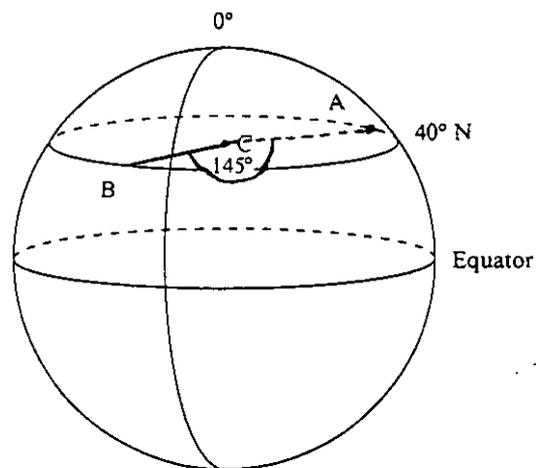
$$AB = 8.147702831\dots$$

$$= 8.15 \text{ (3 s.f.)}$$
 (A1)

Answers: (a) 134° (C2)

(b) 8.15 (C2)

20. (a)



(A2)

Note: Award (A1) for 145° marked, and (A1) for both A and B correctly marked

(b) distance = $\frac{145}{360} \times 30\,800$ (M1)

$$= 12\,405.55\dots$$

$$= 12\,400 \text{ km (3 s.f.)}$$
 (A1)

Answers: (a) see diagram (C2)

(b) 12 400 km (C2)