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121/1 MS
MATHEMATICS (Alt. A)
Paper 1
Nov 2017
MARKING SCHEME

[redacted]

THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

MATHEMATICS (Alt. A)
Paper 1

MARKING SCHEME
(CONFIDENTIAL)

This marking scheme consists of 15 printed pages

No.	Marking Scheme	Marks	Comments
	$\sqrt{\dfrac{0.0961}{4.0836-3.7112}} = \sqrt{0.2581}$	M1	for 0.2581 any no of Sf
	$= 0.5080$	A1	– 0.5081 when logs are used.
	Standard form $= 5.080 \times 10^{-1}$	B1	Do not accept 5.08×10^{-1}
		3	
2.	$189 = 3 \times 3 \times 3 \times 7$	B1	
	$= 3^3 \times 7$		
	$\therefore p^3 \times q = 3^3 \times 7$	B1	for equating.
	$p = 3, q = 7$	B1	
		3	
3.	Let the number of kg of maize be m and numberof kg of beans be b		
	Buying price $= 20m + 60b$	B1	
	Selling price $= 48(m+b)$		
	$\dfrac{60}{100} = \dfrac{48(m+b)-(20m+60b)}{20m+60b}$ – % profit	M1	or equivalent
	$0.6 = \dfrac{28m-12b}{20m+60b}$		
	$\Rightarrow 12m + 36b = 28m - 12b$ $16m = 48b$	M1	for removal of denominator & Symplifying
	$\dfrac{m}{b} = \dfrac{3}{1}$		20 60 → 30 → 30 10 B1 M1 M1
	$\therefore$ Ratio m:b = 3:1	A1	3 : 1 A1
		4	

$\frac{160}{160} \times 48 = 30$.

for 1 Kg of mixture
let maize be x
beans $= 1 - x$

$20x + 60(1-x) = 30$ B1 M1
$20x + 60 - 60x = 30$ M1
$-40x = -30$
$x = \frac{3}{4}$

$x : 1-x = \frac{3}{4} : \frac{1}{4}$
$= 3 : 1$ A1

4.	$\angle BAC = 180° - (80° + 30°) = 70°$ $\frac{AC}{\sin 80°} = \frac{12}{\sin 70°}$ $AC = 12.58$ cm Area of $\Delta ABC = \frac{1}{2} \times 12 \times 12.58 \sin 30°$ $= 6 \times 12.58 \times 0.5$ $= 37.74$ cm^2	M1 M1 A1 3	or equivalent $\frac{AB}{\sin 80} = \frac{12}{\sin 70}$ M1 $AB = 6.385$ cm $A = \frac{1}{2} \times 12 \times 6.385 \sin 80°$ M1 $= 37.73$ cm^2 A1
5.	No. of sides of a hexagon = 6 Each exterior angle, $x = \frac{360}{6}$ $= 60°$ Size of each interior angle $= 180° - 60°$ $= 120°$	B1 B1 2	Size of interior $\angle = \frac{(2 \times 6 - 4) \times 90°}{6}$ $= 120°$ B1 B1
6.	No. Log $(1.654)^2$ 0.2185 × 2 0.4370 45.73 1.6602 0.56 $\bar{1}.7482$ or (-0.2518) 1.4084 $\bar{1}.0286$ or $(-0.9714) \times \frac{1}{3}$ $\bar{1}.6762$ or -0.3238 $= 0.4745$	M1 M1 M1 A1 4	All logs correct 0.2185, 1.6602, $\bar{1}.7482$ Correct squaring and multiplication for 0.4370 and 1.4084 Correct cube root and division for $\bar{1}.6762$ or -0.3238 accept 0.4744 if anti-log tables are used.

7.	(a) $\frac{2x}{3}+\frac{5y}{7}=1$ $14x+15y=21$ $y=\frac{-14}{15}x+\frac{21}{15}$ gradient of L = $\frac{15}{14}$ (b) Equation of L $\frac{y-11}{x-4}=\frac{15}{14}$ $y=\frac{15}{14}x+\frac{47}{7}$	B1 M1 A1 3	accept decimal to atleast 4 s.f. eg. 1.071 $y=mx+c$ m1 $11=\frac{15}{14}(4)+c \Rightarrow c=\frac{47}{7}$ $y=\frac{15}{14}x+\frac{47}{7}$ A1
8.	$\pi^c=180°$ $\frac{2\pi^c}{9}=\frac{180\times\frac{2\pi}{9}}{\pi}$ $=40°$	M1 A1 2	$\frac{2\pi}{9}^c = 3.142\times\frac{2}{9} = 0.6982$ $40.107°$ m_1A_1 (from tables)
9.	Area = $\frac{1}{2}\times b\times h$ Let h be the other shorter side $346.8=\frac{1}{2}\times 17\times h$ h = 40.8 longest side = $\sqrt{17^2+40.8^2}$ $=\sqrt{1953.64}$ = 44.2m	M_1 A1 M1 A1 3	

10.	$L_1 : y - x \leq 1$ $L_2 : x < 4$ $L_3 : x + 2y \geq 6$	B1 B1 B1 3	or equivalent $y \leq x+1$ or equivalent $x-4<0$ or equivalent $y \geq -\frac{1}{2}x+3$.
11.	$\frac{840}{x} - \frac{840}{x+1} = 4$ $4x^2 + 4x - 840 = 0$ $x^2 + x - 210 = 0$ $(x+15)(x-14) = 0$ $x = 14$ No of seedling planted by Murimi per row $= \frac{840}{14}$ $= 60$	M1 M1 A1 B1 4	
12.	£500 000 to Ksh = 50 000 × 130.10 = Ksh 6 505 000 Balance after expenditure $= \frac{20}{100} \times 6\,505\,000$ = Ksh 1 301 000 Amount in Rands $= \frac{1\,301\,000}{9.58}$ ~~R 155 804~~ 135 804	B1 B1 B1 3	$\frac{20}{100} \times 50000 \times 130.10$ 9.58 $= 135\,804$ B, B, B C.A.O (correct answer only).

Mid ordinates are

x	-3	-1	1	3	5	7
y	10	2	2	10	26	50

Area = 2 (10 + 2 + 2 + 10 + 26 + 50)

= 200

B1

M1

A1

3

Delay mark if all values of y are given from -4 to 8 with at least one

$$3\begin{pmatrix}4\\3\end{pmatrix}-2\begin{pmatrix}x\\y\end{pmatrix}+4\begin{pmatrix}-2\\-5\end{pmatrix}=\begin{pmatrix}10\\-19\end{pmatrix}$$

$$\begin{pmatrix}4-2x\\-11-2y\end{pmatrix}=\begin{pmatrix}10\\-19\end{pmatrix}$$

M1

$4 - 2x = 10$

$-2x = 6$

$x = -3$

$-11-2y = -19$

$-2y = -8$

$y = 4$

M1

Attempt to solve for x and y

Do not apply OW-1 for vector sign.

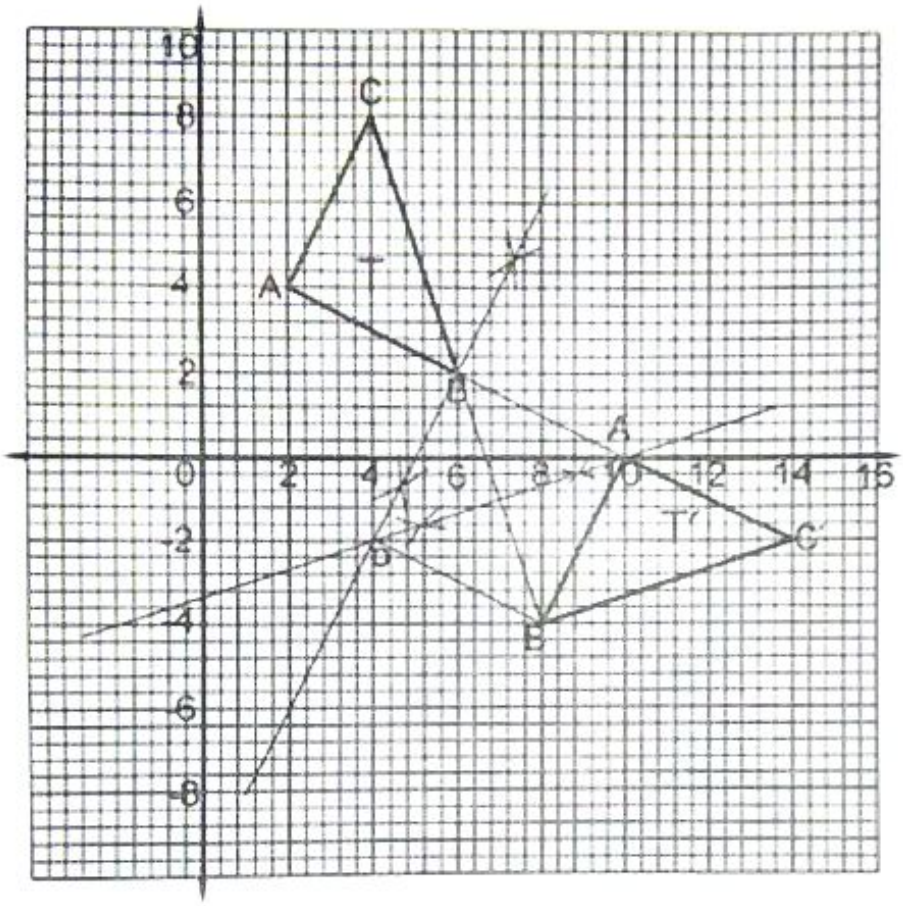
or $2b = \begin{pmatrix}-6\\8\end{pmatrix}$

or $-2b = \begin{pmatrix}6\\-8\end{pmatrix}$

$$b = \begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}-3\\4\end{pmatrix}$$

A1

3

5. (a)			Vertical scale and horizontal scale must be equal.
		B1	for T (ΔABC)
		B1	for T' (ΔA'B'C')
(b)	Centre of rotation (4, -2)	B1	Centre stated or can be shown
	Angle of rotation – 90°	B1	negative quarter turn (if minus for centre is wrong then that mark is lost)
		4	
6.	$3t + 2a = 9000$ $4t + a = 9500$ $a = 9500 - 4t$ $3t + 2(9500 - 4t) = 9000$ $-5t = -10000$ $t = 2000$	M1	Attempt to solve removal of 1 unknown
	$\Rightarrow a = 9500 - 8000 = 1500$	A1	For both values of a and t
	Cost of hiring 2 technicians 5 artisans	B1	
	$= 2\times2000 + 5 \times1500 = \text{Ksh } 11500$	3	

17.	(a) $2y - 3x = 6$ $3y + x = 20$ $2y - 3x = 6$ $9y + 3x = 60$ $11y = 66$ $y = 6$ $x = 20 - 18$ $= 2$ Coordinates of A are (2, 6)	M1 A1 B1	Attempt to solve removal of 1 unknown for x = 2 y = 6
	(b) $L_2 : 3y = -x + 20$ $y = -\frac{1}{3}x + 20$ Gradient of perpendicular = 3 $\frac{y-6}{x-2} = 3$ $y = 3x - 6 + 6$ $y = 3x$	B1 M1 A1	for grad. = 3 $6 = 3(2) + c$ M1 $c = 0$ $y = 3x$ A1
	(c) Gradient of L_4 = gradient of L_1 $= \frac{3}{2}$ $\frac{y-3}{x+1} = \frac{3}{2}$ $2y - 6 = 3x + 3$ $2y - 3x = 9$ When $x = 0$ $y = 4.5$ When $y = 0$ $x = -3$	M1 A1 B1 B1 10	$3 - \frac{3}{2}(-1) + c$ M1 or equivalent for $y = 4.5$ for $x = -3$ (Must not be given in fraction form)

(a)

Mass Kg	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79
Freq. (f)	2	4	8	9	11	7	5	3	1

B1 correct classes

B1 correct frequencies

(b) (i) Mean =

$$\frac{2 \times 37 + 4 \times 42 + 8 \times 47 + 9 \times 52 + 11 \times 57 + 7 \times 62 + 5 \times 67 + 3 \times 72 + 1 \times 77}{50}$$

B1 correct midpoints

$$= \frac{2775}{50}$$

M1

$$= 55.5 \text{ kg}$$

A1

(ii) C.f's 2,6,14,23,34,41,46,49,50

B1

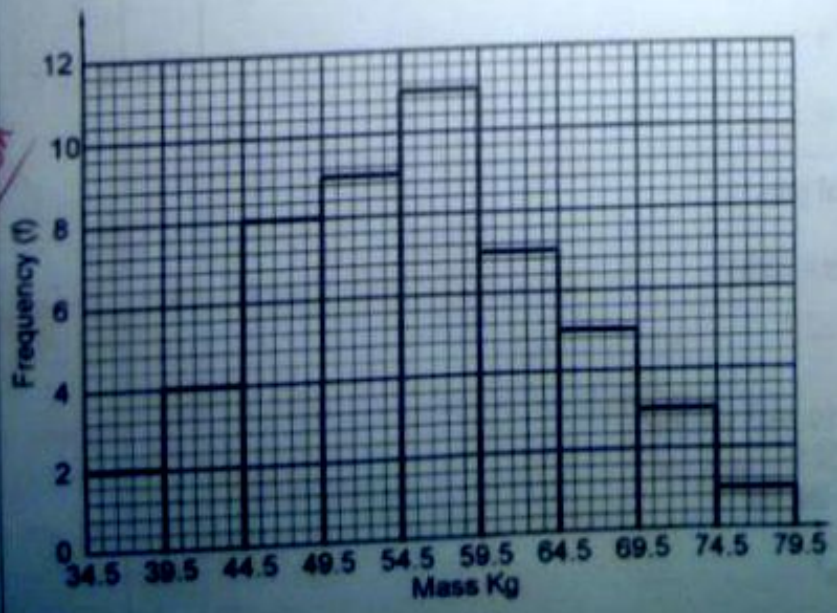
$$\text{Median} = 54.5 + \frac{2}{11} \times 5$$

M1

$$= 55.4 \text{kg}$$

A1

(c)



B1 correct boundaries

B1 correct bars (all of them)

(allow use of correct frequency densities)

10

Mean = $\frac{2805}{50}$ B_1 M_1

$= 56.1$ A_1

$54.5 + \left(\frac{\frac{50}{2} - 23}{11}\right) \times 5$

alt $\frac{58+58}{2}$ M_1

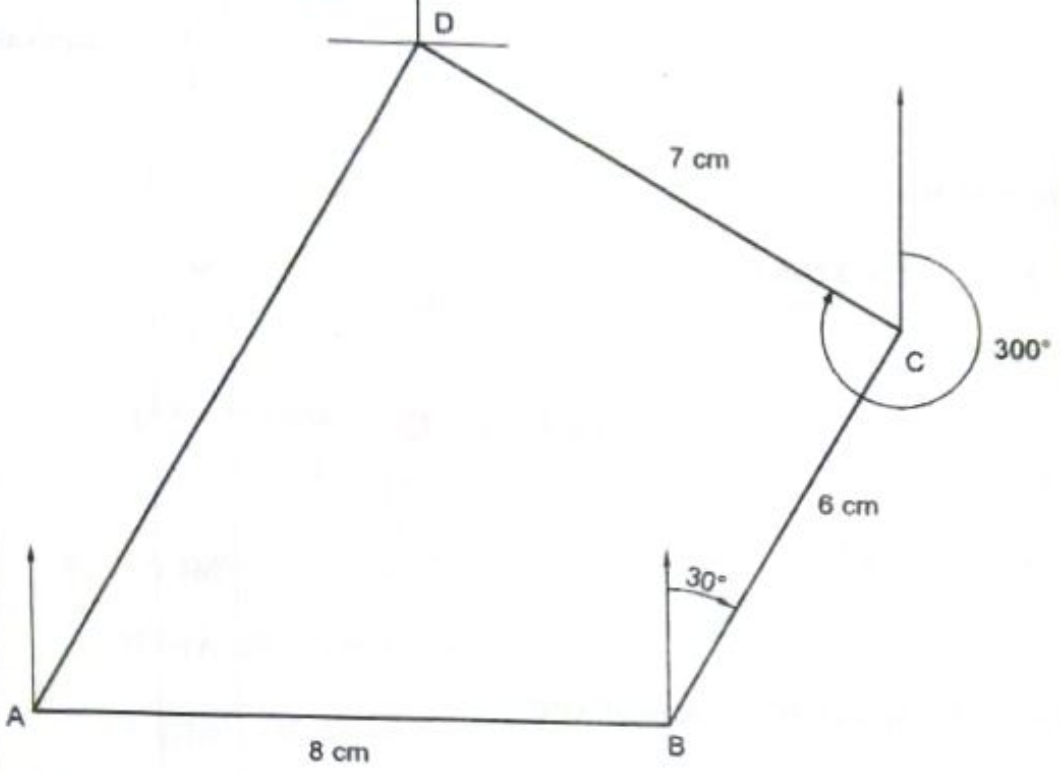
58 A_1 (when arranged) B_1 for arranging in order.

19.	(a) Volume of Solid S Volume of conical part $= \frac{1}{3}\pi \times (0.9)^2 \times 1.5$ $= 1.3m^2$	M1	
	Volume of cylindrical part $= \pi \times (0.9)^2 \times 3$ $= 7.6m^3$	M1	
	Volume of ~~pillar~~ solid $= 1.3 + 7.6$ $= 8.9m^3$	M1 A1	
	(b) S.A. of Solid S Slant length of conical part $= \sqrt{(1.5)^2 + (0.9)^2} = 1.749$	M1 ~~B1~~	
	S.A. of conical part $= \pi \times (0.9) \times 1.749$ ~~$= 4.8m^2$~~ 4.945	M1	
	S.A. of cylindrical part $= 2\pi \times 0.9 \times 3 + \pi \times (0.9)^2$ ~~$= 19.5m^2$~~ 19.51 (19.52)	M1	follow through.
	S.A. of Solid S $= 19.5m^2 + 4.945$ ~~$4.8m^2$~~ $= 24.46 m^2$ ~~$= 24.3m^2$~~		accept 4.947 when $\pi = 3.142$ 4.946 24.47 when $\frac{22}{7}$ is used
	(c) $(1.6)^2 \times h = 8.9m^3$ $h = 3.5m$	A1 M1 A1	
		10	

20. (a)	Length DC $= \sqrt{3^2 + 5^2}$ $= 5.8\text{cm}$	M1 A1	
(b)	$\tan^{-1}\frac{5}{3} = 59.0°$ A1	M1 A1	or equivalent follow through
(c)	Size of angle ACB $11^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \cos C$ $\cos C = \frac{5^2 + 8^2 - 11^2}{2 \times 5 \times 8}$ $= -0.4$ $\angle ACB = \cos^{-1}(-0.4)$ $\angle ACB = 113.6°$	M1 M1 A1	
(d)	Area of ABCD = Area of ACD + Area of ABC $= \frac{1}{2} \times 3 \times 5 + \frac{1}{2} \times 5 \times 8 \sin 113.6$ $= 25.8\text{cm}^2$	 M1 M1 A1	
		10	

21.

If a different scale is used Mark according but penalise for MR-2.



(a) √Location of B	B1
√ Location of C	B1
√ Location of D	B1
Complete quadrilateral ABCD (AD shown be a complete line) (all)	B1 Penalise if AD is not complete
(b) (i) Bearing of A from D = 180 + 30	
= 210° ±1° all S30°W	B1
(ii) Distance BD = 9.2 cm × 1 km/1cm	M1 for conversion
(iii) = 9.2 km ±0.1	A1
(d) Perimeter:	
AD = 10.0 ±0.1 km	B1

	Perimeter = 10 + 8 + 6 + 7 = 31 km	M1 A1 10	
22	(a) $\begin{pmatrix} 3 & x \\ x+1 & 2 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix} = \begin{pmatrix} 3+3x & 6 \\ x+7 & 2x+2 \end{pmatrix}$	M1 A1	for ✓ multiplication & A6
	$\begin{vmatrix} 3+3x & 6 \\ x+7 & 2x+2 \end{vmatrix} = 0$		
	$\Rightarrow (3+3x)(2x+2) - 6(x+7) = 0$	M1	
	~~$6x + 6x^2 + 6x - 6x - 36 = 0$~~ $6x + 6 + 6x^2 + 6x - 6x - 42 = 0$		
	$6x^2 + 6x - 36 = 0$		
	$x^2 + x - 6 = 0$		
	$(x+3)(x-2) = 0$	A1	for both 2 and -3
	$x = 2 \text{ or } -3$		
	(b) (i) $3x + 5y = 165$ $2x + 4y = 120$	B1	for both equns.
	(ii) $\begin{pmatrix} 3 & 5 \\ 2 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 165 \\ 120 \end{pmatrix}$		
	Let $A = \begin{pmatrix} 3 & 5 \\ 2 & 4 \end{pmatrix}$		
	$A^{-1} = \frac{1}{2}\begin{pmatrix} 4 & -5 \\ -2 & 3 \end{pmatrix}$	B1	
	$\frac{1}{2}\begin{pmatrix} 4 & -5 \\ -2 & 3 \end{pmatrix}\begin{pmatrix} 3 & 5 \\ 2 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{2}\begin{pmatrix} 4 & -5 \\ -2 & 3 \end{pmatrix}\begin{pmatrix} 165 \\ 120 \end{pmatrix}$	M1	allow use of other letters other than x and y
	$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 30 \\ 15 \end{pmatrix}$		

Kramer's Rule $x = \dfrac{\begin{vmatrix} 165 & 5 \\ 120 & 4 \end{vmatrix}}{\begin{vmatrix} 3 & 5 \\ 2 & 4 \end{vmatrix}} = \dfrac{60}{2} = 30$

$y = \dfrac{\begin{vmatrix} 3 & 165 \\ 2 & 120 \end{vmatrix}}{\begin{vmatrix} 3 & 5 \\ 2 & 4 \end{vmatrix}} = \dfrac{30}{2} = 15$

for $\frac{60}{2}$ and $\frac{30}{2}$ M1

30, 15 A1

	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 30 \\ 15 \end{pmatrix}$ Cost of an exercise book = Ksh. 30 Cost of a pen = Ksh. 15	A1	for 30 and 15
	(iii) $2 \times 36 \times 30 + 36 \times 15$ = Ksh 2700	M1 A1 **10**	with Σ
23.	(a) (i) Original price = $\frac{16200}{x}$	B1	
	(ii) Price after discount = $\frac{16200}{x+3}$ or $\frac{16200}{x} - 60$	B1	
	(b) (i) $\frac{16200}{x} - 60 = \frac{16200}{x+3}$	M1	
	$\frac{16200 - 60x}{x} = \frac{16200}{x+3}$ $(16200 - 60x)(x+3) = 16200x$ $60x^2 + 180x - 48600 = 0$ $x^2 + 3x - 810 = 0$	M1	for Quadratic expression equated to zero
	$(x+30)(x-27) = 0$	M1	factor equated to zero
	$x = 27$	A1	for 27 after discrimination
	(ii) $\frac{16200}{27+3}$	M1	
	= Ksh 540	A1	
	(iii) $\frac{16200}{27} \times \frac{15}{100}$	M1	600 − 510 M1
	= Ksh 90	A1 **10**	

(i) When $x = 2$		
$y = 2(2)^3 - \frac{9}{2}(2)^2 - 15(2) + 3$	M1	
$= -29$	A1	
(ii) $\frac{dy}{dx} = 6x^2 - 9x - 15$	B1	
at $x = 2$		
$\frac{dy}{dx} = -9$	B1	
Equation of tangent;		
$\frac{y+29}{x-2} = -9$	M1	
$y = -9x + 18 - 29$		
$y = -9x - 11$	A1	or equivalent.
(b) $\frac{dy}{dx} = 6x^2 - 9x - 15$		
At turning point		
$6x^2 - 9x - 15 = 0$	M1	Equating to zero
$6x^2 + 6x - 15x - 15 = 0$		
$(6x - 15)(x + 1) = 0$		
$x = -1$ or 2.5	A1	for both values of x.
at $x = -1$; $y = 11.5$		
turning point = (-1, 11.5)	B1	
at $x = 2.5$, $y = -31\frac{3}{8}$		
turning point = $\left(2.5, -31\frac{3}{8}\right)$ or $(2.5, -31.375)$ with no rounding off i.e. dont accept $(2.5, -31.38)$	B1	Comma must be seen with brackets
	10	