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

THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

MATHEMATICS (Alt. A)

PAPER 1

MARKING SCHEME
(CONFIDENTIAL)

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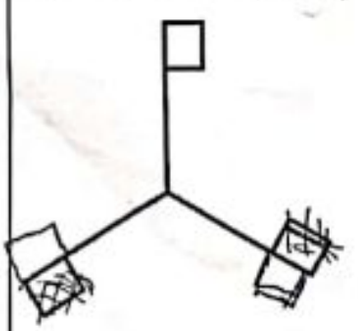
This marking scheme consists of 15 printed pages

No.	Marking Scheme	Marks	Comments
1.	Num $= \frac{9}{5} \div \frac{2}{3}$ of $\frac{9}{4} - \frac{3}{10}$		
	$= \frac{9}{5} \div \frac{3}{2} - \frac{3}{10}$		
	$= \frac{9}{5} \times \frac{2}{3} - \frac{3}{10}$		
	$= \frac{6}{5} - \frac{3}{10}$ of $\frac{12-3}{10}$	M1	Equivalence $\frac{6}{5} - \frac{3}{10}$ e.g. $\frac{12}{10} - \frac{3}{10}$
	$= \frac{9}{10}$		
	Den $= \frac{5}{6} + \frac{22}{39} \times \frac{13}{11}$		
	$= \frac{5}{6} + \frac{2}{3} = \frac{5+4}{6}$	M1	Equivalence
	$= \frac{9}{6} = \frac{3}{2}$		
	Num ÷ Den $= \frac{9}{10} \div \frac{3}{2}$		
	$= \frac{9}{10} \times \frac{2}{3}$	M1	Combining
	$= \frac{3}{5}$	A1	Accept 0·6
		4	
2.	L.C.M $= 5 \times 6 \times 7$	M1	→ 5X3X5X7 (When he extract factors of LCM)
	$= 210$ min $= 3$h 30 min		
	Time they will ring together again		
	$= 8.48$ am $+ 3$h 30 min	M1	(process) Correct addition
	$= 12.18$ pm	A1	12:18 pm or 12:18 hrs or 1218
	(NB Allow subsequent addition)	3	NB DO NOT ALLOW 12:18
3.		B1	120° seen or measured ±1° Measure
		B1	1st arm ✓ — Correctly drawn
		B1	2nd arm ✓ — Correctly drawn
		3	

Arm = 0·8 ±0·1 or 0·5 ±0·1

No.	Marking Scheme	Marks	Comments
4.	$\frac{5}{3} - 2x < 1 - \frac{2}{3}x$ $5 - 6x < 3 - 2x$ $2 < 4x$ $\frac{1}{2} < x$	B1	$x > \frac{1}{2}$
	$1 - \frac{2}{3}x \leq 2 - x$ $x - \frac{2}{3}x \leq 2 - 1$ $\frac{1}{3}x \leq 1$ $x \leq 3$	B1 A1	If he uses = sign and eventually writes $\frac{1}{2} < x \leq 3$ — B1 B1
	$\frac{1}{2} < x \leq 3$		
	Integral values 1, 2, 3	B1 3	
5.	Let the polygon be n sided $(n-2)180 = 90 + 90 + 150(n-2)$	M1	Exterior angle $= 360$ $90+90+x(180-150)$ $30x = 180$ $x = 6$
	$180n - 360 = 180 + 150n - 300$ $30n = 360 + 180 - 300 = 240$	M1	$30n = 240$ $n = 6+2 = 8$
	$n = 8$	A1 3	M1 M1 A1
6.	Time taken by Kipsang to run 300 m $= \frac{300}{5}$	M1	$\frac{310}{5} - \frac{10}{5}$ or $62-2$
	$= 60$ sec Mutungas speed $= \frac{(310 + 50)}{60}$	M1	$\frac{360}{60}$
	$= 6$ m/s	A1 3	

6) Alternative

$300 : 5 = 360 : x$

$\frac{300}{5} = \frac{360}{x}$

$x = 6$ m/s M1 M1 A1

B) Alternative

$90+90+(n-2)180 = 360$ M1

$(n-2)30 = 180$

$30n = 240$ -- M1

$n = 8$ A1

No.	Marking Scheme	Marks	Comments
7.	$(4+2y)^2-(2y-4)^2$ $=[(4+2y)-(2y-4)][(4+2y)+(2y-4)]$ $=[4+2y-2y+4][4+2y+2y-4]$ $=8\times 4y$ $=32y$	M1 A1 2	Brackets opened & two combined $16+16y+4y^2-4y^2+16y-16$
8.	Commission earned on selling Table $=\frac{8}{100}\times 4500$ ---- (i) $=$ sh 360 (i) Chair $=\frac{5}{100}\times 2000$ ---- (ii) $=$ sh 100 (ii) Let the no. of chairs sold $= x$ $360(x-3)+100x=3980$ $460x=5060$ $x=11$	M1 M1 A1 3	process of getting commission. (360 & 100) Any of (i) and (ii) Alternative $360x+100(x+3)=3980$ $x=8$ No of Chairs $=8+3=11$ M1A1
9.	(a) $T=\begin{pmatrix}3\\5\end{pmatrix}-\begin{pmatrix}-6\\2\end{pmatrix}=\begin{pmatrix}9\\3\end{pmatrix}$ (b) $\begin{pmatrix}a\\b\end{pmatrix}=\begin{pmatrix}-4\\2\end{pmatrix}-\begin{pmatrix}9\\3\end{pmatrix}$ $a=-13,\ b=-1$ $P(-13,-1)$ or $(-13,-1)$	B1 M1 A1 3	Seeing $\begin{pmatrix}9\\3\end{pmatrix}$ Seeing $\begin{pmatrix}9\\3\end{pmatrix}$ (implies) or $P=(-13,-1)$ Accept
10.	Distance from A to B (Using Johns Vehicle) $=\frac{12\times 2805}{110}$ $=306$ km Cost of fuel that Jane would required $=\left(\frac{12.5\times 306}{100}\right)\times 110$ $=$ Ksh 4207.50 or Sh 4,207·5 Accept Sh 4,208 Not correct	M1 M1 A1 3	Alternative 12 km/h = 2805 8 km/h = ? $\frac{12}{8}\times 2805$ — M1 M1 $=4207.5$ — A1 Alternative $\frac{2805}{10}=25.5$ $25.5\times 12=306$ — M1 12.5 → 100 ? ← 306 $\frac{12.5\times 306}{100}=38.25$ 38.25×110 M $=4207.50$ A1

Alternative
Let Chairs $=x$
Let table $=y$
$100x+360y=3990$ M1
$x-y=3$
$y=x+3$
$460x=5060$ M1
$x=11$ A1

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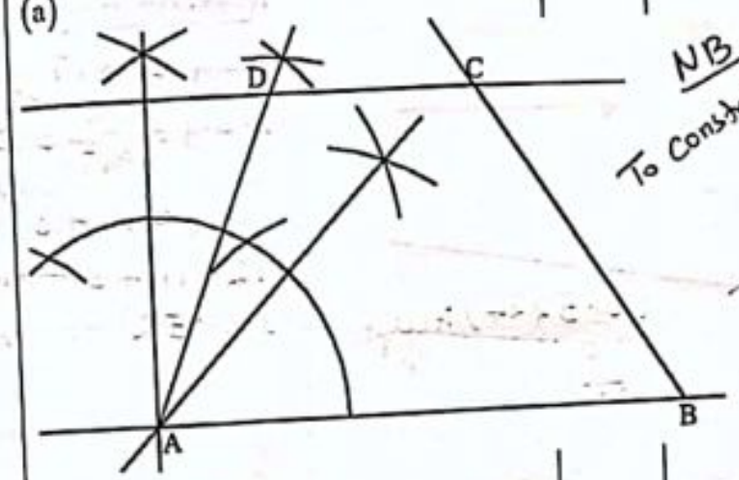
No.	Marking Scheme	Marks	Comments
11.	$2\theta - 15 + 30 = 90$ $50 = 105$ $\theta = 21°$	M1 A1 2	
12.	(a) 	B1 B1 B1 B1 4	Construction of 67.5° at A and locating of point D. ✓ Construction of DC//AB ✓ Trapezium ABCD
	(b) DC = 3cm ± 0.1 3.1 ± 0.1		
13.	Departure (from Msa) = 2.30 am = 0230h (Tue) Arrival (Mtito Andei) = 0230 + 3h12min = 0542h (Tue) NB: 36hrs = 1day 12hours Departure (Mtito Andei) = 0542h (Tue) + 1day + 12 hrs = 0542h (wed) + 12hours = 1742hrs (Wed) Arrival (Nairobi) = 1742 + 5h 25min = 2307 h = 11.07 pm Wednesday	M1 M1 A1 3	Alternatives ① 2:30 + 3hrs 12min + 36hrs + 5hrs 25min = 4707 hours = 4707 − 24hrs = 2307hrs M1 = 11.07 pm Wed A1 ② 2:30 + 3hrs 12M + 36hrs + 5hrs 25M = 4707 hrs 2400 − M1 2307 hrs = 11.07 pm Wed A1 (Time & day)

11:07 pm X No Wednesday A0

2·30 + 3·12 +

No.	Marking Scheme	Marks	Comments
14.	V.S.F $= \frac{7}{8} : 1$		
	$= 7 : 8$	M1	$\rightarrow \frac{\sqrt[3]{7}}{2}$ or $\frac{1.913}{2}$
	L.S.F $= \sqrt[3]{7} : 2$		Alternative
	Let the height of frustum $= x$		V.S.f $= 8:7$ — M1
	$\frac{12-x}{12} = \frac{\sqrt[3]{7}}{2} = \frac{1.913}{2}$	M1	L.S.f $= \frac{2}{\sqrt[3]{7}} = \frac{2}{y}$
	$24 - 2x = 22.956$		$y = 11.48$
	$2x = 1.044$	A1	$12 - 11.48$ — M1
	$x = 0.522$ cm (0.5224) Accept	3	$= 0.52$ — A1
15.	$8^{x+1} - 2^{3x-1} = 120$		
	$(2^3)^{x+1} - 2^{3x-1} = 120$		
	$2^{3x+3} - 2^{3x-1} = 120$		
	$2^{3x} \times 2^3 - \frac{2^{3x}}{2} = 120$	M1	Addition & Subtraction of Indices reversed (Splitting)
	$2^{3x}\left(2^3 - \frac{1}{2}\right) = 120$	M1	
	$2^{3x} = 120 \times \frac{2}{15} = 16 = 2^4$	M1	or $2^{3x} = 2^4$
	$3x = 4$	M1	
	$x = 1\frac{1}{3}$ OR 1.3 or 1.33...	A1	
	$x = 4/3$ A0	4	

NB

Alternative

$2^{3x} \cdot 2^3 - 2^{3x} \cdot 2^{-1} = 120$ — M1

$2^{3x} = 2^4$ — M1

$3x = 4$ — M1

$x = 1\frac{1}{3}$ + A1

$8^x \cdot 8 - 2$

No.	Marking Scheme	Marks	Comments
16.	(a) $\frac{dy}{dx} = 6x^2 - 6x - 12$	B1	
	(b) At $x = 1$		
	$\frac{dy}{dx} = 6\times1 - 6\times1 - 12 = -12$	M1	-Substituting
	$m_1 \times -12 = -1$		
	$m_1 = \frac{1}{12}$		
	$\frac{y+1}{x-1} = \frac{1}{12}$	M1	Using $y = mx + c$ $(1,-1)$ $-1 = \frac{1}{12}(1) + c$ ← M1 (substitution)
	$12(y+1) = x - 1$		
	$y + 1 = \frac{1}{12}x - \frac{1}{12}$		
	$y = \frac{1}{12}x - 1\frac{1}{12}$	A1	
	$Y = \frac{1}{12}x - \frac{13}{12}$ Accept		
		4	

NB $y = \frac{1}{12}x - 1.083$ Ao

$(X, Y)\ (1, -1)$

$\frac{Y - -1}{X - 1} = \frac{1}{-12}$

No.	Marking Scheme	Marks	Comments
17.	(a)		
	No. of tins $= \frac{60}{10} \times \frac{30}{10} \times \frac{30}{15}$	M1	$\frac{60}{15} \times \frac{30}{10} \times \frac{30}{10}$
	$= 6 \times 3 \times 2$		
	$= 36$	A1	
	(b)		
	Mass of tin and jam $= 990\,g + 300\,g$	M1	- Change to kg · Alternative $560 + (36 \times 300) + (36 \times 990)$ M
	$= 1290\,g$		
	Mass of carton full jam tins		
	$= (560 + 1290 \times 36)\,g$	M1	$\frac{600}{47}$
	$= 47000\,g$		
	$= 47\,kg$		
	Let N be the number of cartons carried by pick up		
	$47N \leq 600$	M1	$47N = 600$
	$N \leq 1276$ 12.77		
	Max N = 12	A1	
	(c)		
	Retailers S.P		Alternative
	$= Ksh(110 \times 36)$	M1	$B;P = \frac{2880}{36}$
	$= Sh\ 3960$ per carton		
	Retailers profit $= Ksh(3960 - 2880)$	M1	$110 - 80$
	$= sh1080$		
	Retailers % profit		
	$= \frac{1080}{2880} \times 100$	M1	$\frac{30}{80} \times 100$
	$= 37.5\%$	A1	37.5%
		10	
18.	(a)		

No.	Marking Scheme	Marks	Comments
18	Area of equilateral triangle		OR OR $\frac{1}{2}\times$base
	$= \frac{1}{2}\times 10\times 10\times \sin 60$	M1	$\sqrt{15(15-10)(15-10)(15-10)}$ or $\sqrt{15625}$
	$= 43.30$ sq units	A1	
	(b) Volume of triangular ~~prism~~ pyramid VABC		
	$= \frac{1}{3}\times 43.30\times 15$	M1	OR $\frac{1}{3}\times 43.3\times 15$ Accept M1 but Answer = A0
	$= 216.5\ \text{cm}^3$	A1	
	(c) (i) h = Height of cone		
	$\frac{1}{3}\times\frac{22}{7}\times 3.5^2\times h = 216.5$	M1	
	$h = \left(\frac{3\times 7\times 216.5}{22\times 3.5^2}\right)$		
	$= 16.87$ cm	A1	16.88 (Accept) F.T.
	(ii) Let l = slant height of cone		
	$l = \sqrt{(3.5^2+16.87^2)}$	M1	
	$= \sqrt{296.8}$		
	$= 17.23$ cm	A1	(17.24cm) Accept
	Surface area of cone		
	$= \frac{22}{7}\times 3.5^2 + \frac{22}{7}\times 3.5\times 17.23$	M1	
	$= 38.5+189.53$		
	= ~~228.0 cm² Or~~ 228.03	A1	228.05 ✓ 228.08 ✓ 229.97 ✓ Accept
		10	

Alternative

$S.A = \pi r^2 + \pi r l = \pi(35)\left[(35) + \sqrt{3.5^2+16.87^2}\right]$ M1M1M1 A1 $= 228.03$

No.	Marking Scheme	Marks	Comments
19.	(a) $25x + 35y = 13500$ or $5x + 7y = 2700$	B1	
	$21x + 38y = 12200$	B1	
	(b) $\begin{pmatrix} 5 & 7 \\ 21 & 38 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2700 \\ 12200 \end{pmatrix}$		
	Determinant of coefficient matrix		
	$= 5\times38 - 7\times21$		
	$= 43$		
	Inverse of coefficient matrix		OR
	$= \frac{1}{43}\begin{pmatrix} 38 & -7 \\ -21 & 5 \end{pmatrix}$	M1	for inverse $\frac{1}{215}\begin{bmatrix} 38 & -3 \\ -21 & 2 \end{bmatrix}$
	$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{43}\begin{pmatrix} 38 & -7 \\ -21 & 5 \end{pmatrix}\begin{pmatrix} 2700 \\ 12200 \end{pmatrix}$	M1	pre multiplying by inverse (seeing Premultiply)
	$= \frac{1}{43}\begin{pmatrix} 38\times2700 + -7\times12200 \\ -21\times2700 + 5\times12200 \end{pmatrix}$	M1	Attempting to solve
	$= \frac{1}{43}\begin{pmatrix} 17200 \\ 4300 \end{pmatrix}$		
	$= \begin{pmatrix} 400 \\ 100 \end{pmatrix}$ — A Single matrix	M1	Simplifying
	Textbook = sh.400 Exercise book sh.100	A1	For both
	(c) Amount spent by Kasuku school		
	$= 25\times\frac{95}{100}\times400 + 35\times\frac{105}{100}\times100$	M1	$(25\times350)+(35\times105)$
	= Ksh 13175		
	Difference		
	= 13500 − 13175	M1	
	= Ksh 325	A1	
		10	

$\begin{bmatrix} 25 & 35 & 13500 \\ 21 & 38 & 12200 \end{bmatrix}$

Det = 215

$\begin{bmatrix} 13500 & 35 \\ 12200 & 38 \end{bmatrix}$ / 215 $x = \frac{51300 - 42700}{215} = 400$

$\begin{bmatrix} 25 & 13500 \\ 21 & 12200 \end{bmatrix}$ / 215 $y = \frac{30500 - 28300}{215} = 100$ M1M1M1A1

No.	Marking Scheme	Marks	Comments
20.	(a)(i) $AC^2 = 8^2 + 6^2 - 2\times8\times6\times\cos 70$	M1	Substitution
	$= 67.17$		
	$AC = 8.2$ cm	A1	
	(ii) Length DC		
	$\frac{1}{2}$ of AC $= \frac{1}{2}$ of 8.2 cm $= 4.1$ cm		
	$\sin 25 = \frac{4.1}{DC}$	M1	$\frac{8.2}{\sin 50} = \frac{DC}{\sin 65^\circ}$ OR $\cos 65^\circ = \frac{4.1}{DC}$
	$DC = \frac{4.1}{\sin 25}$		
	$= 9.7$ cm	A1	
	(iii) Angle BAD		
	$\frac{8.2}{\sin 70} = \frac{6}{\sin BAC}$	M1	expression
	$\sin BAC = \frac{6\times\sin 70}{8.2}$		
	$BAC = \sin^{-1} 0.6876$		
	$BAC = 43.44$		F.T
	Base angles of triangle DAC		
	$= \frac{180-50}{2}$		
	$= 65^\circ$		OR 65+43.4
	$\angle BAD = 65 + 43.44$	M1	Addition
	$= 108.4^\circ$	A1	
	(b) Area of quadrilateral		
	$= \frac{1}{2}\times8\times6\times\sin 70 + \frac{1}{2}\times9.7^2\times\sin 50$ (M1 M1)	M1M1	
	$= 22.55 + 36.04$	A1	
	$= 58.6\ cm^2$	10	

No.	Marking Scheme	Marks	Comments
21.	(a) $(x-4)^2 = (x-8)(2x+7)$		
	$x^2 - 8x + 16 = 2x^2 + 7x - 16x - 56$ ← Removal of brackets	M1	Expansion & br removes
	$x^2 - x - 72 = 0$ ← $x^2 - x = 72$	M1	or its equival
	$(x-9)(x+8) = 0$	M1	factorisation
	$x = 9$ or $x = -8$	A1	√ has been taken out
	(b)		
	Time taken by John $= \frac{6}{2x-3}$ ..... (i)	B1	either For any (i) or (ii)
	Time taken by Peter $= \frac{2.4}{x}$ ..... (ii)		
	$\frac{6}{2x-3} - \frac{2.4}{x} = \frac{16}{60} = \frac{4}{15}$	M1	
	$6(15x) - 2.4 \times 15 \times (2x-3) = 4x(2x-3)$		
	$90x - 72x + 108 = 8x^2 - 12x$	M1	For expression
$8x^2 - 30x = 108$ ↔	$8x^2 - 30x - 108 = 0$ or $4x^2 - 15x - 54 = 0$		
	$x = \frac{15 \pm \sqrt{(225 - 4 \times 4 \times -54)}}{8}$		
	$x = \frac{15 \pm 33}{8}$ OR $(4x+9)(x-6) = 0$ ↔	M1	When √ has been removed.
	$x = 6$ or $x = -2.25$		
	$x = 6$	A1	
	Time taken by John $= \frac{6}{2x-3} = \frac{6}{2 \times 6 - 3}$		
	$= \frac{6}{9}$ h $= \frac{2}{3}$ h		
2	$= 40$ min	B1	
		10	

No.	Marking Scheme	Marks	Comments
22.	(a)(i) $AB = \begin{pmatrix} -8 \\ 2 \end{pmatrix} - \begin{pmatrix} -4 \\ 6 \end{pmatrix}$	M1	
	$= \begin{pmatrix} -4 \\ -4 \end{pmatrix}$	A1	
	(ii) $M\left(\frac{-4 + -8}{2}, \frac{6 + 2}{2}\right) = M(-6, 4)$	B1	for co-ordinates
	$N(-2, 3)$	B1	for co-ordinates
	(iii) $NM = \begin{pmatrix} -6 \\ 4 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \end{pmatrix}$	M1	column vector
	$= \begin{pmatrix} -4 \\ 1 \end{pmatrix}$		
	$\lvert NM \rvert = \sqrt{(-4)^2 + 1^2} = \sqrt{17}$	M1	Alternative $\sqrt{(-2-6)^2 + (3-4)^2}$ M1M
	$\lvert NM \rvert = 4.123$	A1	$= \sqrt{17}$ $= 4.123$ A1
	(b) $CA = \begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} -2 \\ a \end{pmatrix} = \begin{pmatrix} -2 \\ 6 - a \end{pmatrix}$		
	$\begin{pmatrix} -2 \\ 6 - a \end{pmatrix} = k\begin{pmatrix} -8 \\ 2 \end{pmatrix}$	M1	
	$k = \frac{1}{4}$		
	$6 - a = \frac{1}{2} \times 2$	M1	Attempting to get "a"
	$a = \cancel{5}\frac{1}{2}$ 4.5	A1	
		10	

Alternative

(b)

$-6 : 8$

$6 - a : 2$

$\frac{6-a}{2} = \frac{-6}{-8}$ M1M1

$-48 + 8a = -12$

$\frac{8a}{8} = \frac{36}{8}$

$a = 4.5$ A1

OR CA // OB: gradient are equal

Gradient of $OB = -1/4$

$-1/4 = \frac{a-6}{2--4}$ M1M1

$a = 4.5$ A1

No.	Marking Scheme	Marks	Comments

23. (a)

	Tally	Frequency	Mid-point (x)	xf	CF
40 – 44	////	4	42	168	4
45 – 49	### //	7	47	329	11
50 – 54	### ///	8	52	416	19
55 – 59	### /	6	57	342	25
60 – 64	### //	7	62	434	32
65 – 69	///	3	67	201	35
70 – 74	##	5	72	360	40
		$\sum f = 40$		2250	

B1 B1 B1 B1 B1 B1 B1 B1

B1 √ class interval — correct classes
B1 √ frequencies
B1 √ Mid-points
B1 √ xf (fx) column

(b) Modal class

50 – 54 ← B1

(c) (i)

$\bar{x} = \frac{2250}{40}$ ← M1

$= 56.25$ kg ← A1

(ii) Median student $= 20^{th}$ B1 √ CF

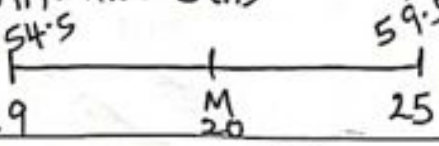
Mass of 20th student

$= 54.5 + \frac{5}{6} \times 1$ ← M1 → $54.5 + \frac{(20-19)}{6} \times 5$ or $54.5 + \frac{5}{6}$

$= 55\frac{1}{3}$ kg ← A1 → 55.33 (4 sig fig) $55.\dot{3}$

NB
Class width is equal
Use of ratio

Alternative C(ii)



10

Allow 55.333

$\frac{M - 54.5}{59.5 - 54.5} = \frac{20 - 19}{25 - 19}$ M1

$\frac{M - 54.5}{5} = \frac{1}{6}$ M1

$= 55.33$

No.	Marking Scheme	Marks	Comments
24.	(a)(i) When $x = -2$		
	$y=\frac{1}{3}\times(-2)^3-\frac{1}{2}\times(-2)^2-2\times(-2)-\frac{1}{3}$	M1	Replaces x with -2 (substitute)
	$=-1$	A1	
	(ii) $\frac{dy}{dx} = x^2 - x - 2$	M1	
	At $x = -2$		
	$\frac{dy}{dx} = 4 + 2 - 2$ $(-2)^2-(-2)-2$	M1	correct substitution
	$= 4$		
	Equation of tangent to the curve at $x=-2$		
	$\frac{y-(-1)}{x-(-2)} = 4$	M1	$\frac{y+1}{x+2}=4$ or $1=4(-2)+c$
	$y + 1 = 4x + 8$		
	$y = 4x + 7$	A1	or its equivalent $y-4x=7$ or $y-4x-7=0$
	(b) $\frac{dy}{dx} = x^2 - x - 2 = 0$ at turning point	M1	or $-\frac{4}{7}x+\frac{y}{7}=1$
	$(x+1)(x-2)=0$	M1	
	$x = 1$ or $x = 2$ $x=-1$ or $x=2$	A1	(Both values)
	Coordinates of the turning points		
	$\left(-1, \frac{5}{6}\right)$ and $\left(2, -3\frac{2}{3}\right)$	A1B1	For both
	NB → CORRECT ANSWER ONLY		
		10	