



121/1 MS
MATHEMATICS (Alt. A)
Paper 1
March 2021
MARKING SCHEME

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2724

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 14 printed pages

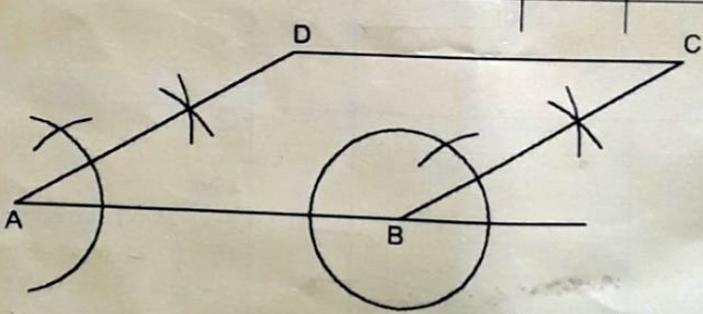
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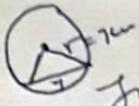
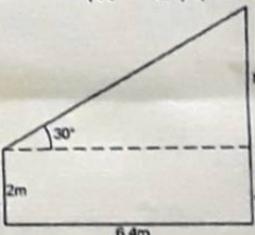
MATHEMATICS ALT. A 121/1 PAPER 1 MARKING SCHEME

Page | 1

No.	Marking Scheme	Marks	Comments
1.	$\frac{-3(6+2) - 12 \div 4 + 5}{-4 \times -6 + -3 \times 5} = \frac{-3 \times 4 - -3 + 5}{24 + -15}$ $\frac{-12 + 3 + 5}{24 - 15} = \frac{-3 \times 4 + 3 + 5}{24 - 15}$ $= -\frac{4}{9}$	M1 M1 A1 3	-12 + 3 + 5 or -12 + 8 - only one operation remaining Simplification of Numerator Simplification of Denominator
2.	<p>Let</p> $x = 5.555\dots$ $10x = 55.55\dots$ $10x - x = 50$ $9x = 50$ $x = \frac{50}{9}$ $= 5\frac{5}{9}$	M1 M1 A1 3	or equivalent Subtraction on both sides
3.	$49^{\frac{3}{2}} \times \left(\frac{256}{2401}\right)^{\frac{3}{4}} = (7^2)^{\frac{3}{2}} \times \left(\frac{2^8}{7^4}\right)^{\frac{3}{4}}$ $= 7^3 \times \frac{2^6}{7^3}$ $= 64$	M1 M1 A1 3	Evidence of factorization and all combined. Fractal indices removed Deny 2^6 16^2 $(2^4)^2$ 2^8
4.	$540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5$ $420 = 2 \times 2 \times 3 \times 5 \times 7$ G.C.D = $2^2 \times 3 \times 5$ $= 60$ Number of tiles = $\frac{540}{60} \times \frac{420}{60}$ $= 63$	M1 A1 M1 A1 4	Process of getting the GCD or Increase of use of M $2 \times 3 \times 0.1 = 0.6$ M1 GCD = 60 Process of getting way of tiles eq: $\frac{5.4 \times 4.2}{0.6}$ M1 $= 63$ A1

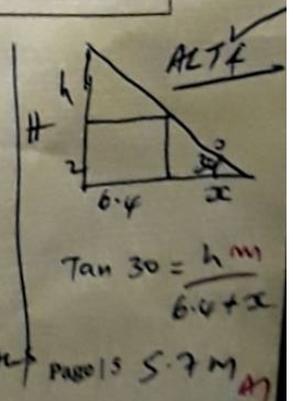
No.	Marking Scheme	Marks	Comments
5.	$\frac{2x^2 - xy - 6y^2}{x^2 - 4xy + 4y^2} = \frac{(2x + 3y)(x - 2y)}{(x - 2y)(x - 2y)}$ $= \frac{2x + 3y}{x - 2y}$	M1 M1 A1	Factorizing Numerator Correct factorization Factorizing Denominator (Correct factorization) accept $(x - 2y)^2$
		3	
6.	Gradient of L = 2 Equation of L $\frac{y + 1}{x - 2} = 2$ $y = 2x - 5$	B1 M1 A1	Or equivalent $\frac{y - -1}{x - 2} = 2$
		3	
7.	Let n = No. of sides $(2n - 4) \times 90^\circ = 1260^\circ$ $n = 9$ Size of each exterior angle = $\frac{360}{9}$ $= 40^\circ$	M1 M1 A1	Or equivalent $(n - 2)180^\circ$ $\frac{1260}{n} + \frac{360}{n} = 180^\circ$ $e = \frac{1260}{9}$ $= 140$ $180 - 140$ $e = 40^\circ$
		3	
8.		B1 B1	Line $-x + 2y = 1$ correctly drawn ✓ any 2 pts on the line ✓ $x - 4y = -5$ correctly drawn ✓ any 2 ✓ pts on the line
	$x = 3, y = 2$	B1 3	For both values

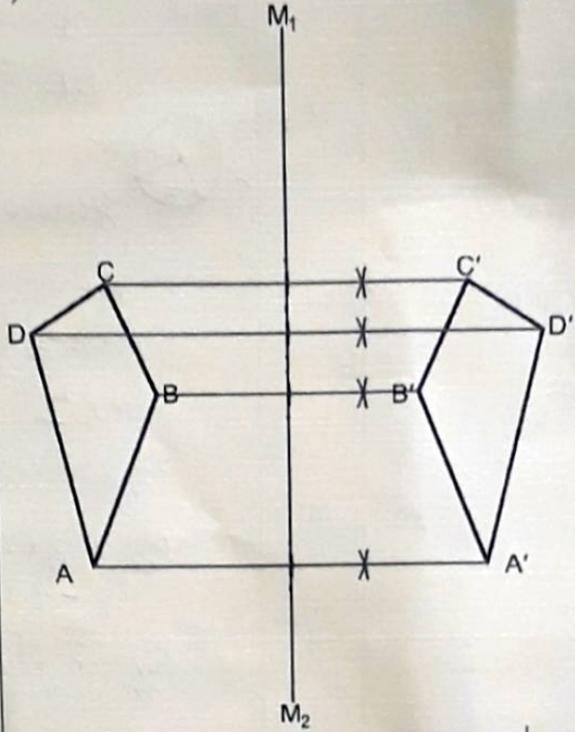
No.	Marking Scheme	Marks	Comments
9.	<p>If $\sin(\theta + 30^\circ) = \cos 2\theta$, then</p> <p>$\theta + 30 + 2\theta = 90^\circ$ →</p> <p>$3\theta = 60^\circ$</p> <p>$\theta = 20^\circ$ →</p> <p>$\cos(\theta + 40^\circ) = \cos 60^\circ$</p> <p style="text-align: center;">$= 0.5$</p>	M1 A1 B1 3	Accept $\theta = 42$
10.	<p>Let $OA = x$</p> <p>$\frac{1}{6} \times \frac{22}{7} \times 2x + \frac{1}{6} \times \frac{22}{7} \times (2x + 14) + 14 = 28\frac{2}{3}$</p> <p>$(2x + 2x + 14) = \left(28\frac{2}{3} - 14\right) \times \frac{42}{22}$</p> <p>$4x = 28 - 14 = 14$</p> <p>$x = 3.5 \text{ cm}$</p>	M1 M1 A1 3	<p>$\frac{1}{6}$ represents $\frac{60}{360}$ total perimeter</p> <p>inner radius.</p> <p>Accept 3.502 for TI: 3.5142 3.503 for calculator TI</p>
11.	<p>30° at A or C 150° at D or B</p>  <p>angles $\pm 1^\circ$ Lengths $\pm 0.1 \text{ cm}$ for broken lines looses but but scores the complete parallel</p>	B1 B1 B1 3	<p>150° constructed at B or 30° at A or at D</p> <p>Lines AB and BC $\sqrt{(6 \text{ cm} \& 5 \text{ cm})}$</p> <p>✓ Complete parallelogram</p> <p>Follow tho' acc. angle $\pm 1^\circ$</p>
12.	<p>(a) Amount received by NGO (In Ksh)</p> <p style="text-align: center;">$= 200000 \times 102.40 = \text{Ksh } 20\,480\,000$</p> <p>(b) Cost of machine (Ksh) $= \frac{90}{100} \times 20\,480\,000$</p> <p style="text-align: center;">$= 18\,432\,000$</p> <p>Cost of machine (JY) $= \frac{18\,432\,000}{93.30} \times 100$</p> <p style="text-align: center;">$= 19\,755\,627$</p>	B1 M1 M1 A1 4	<p>check also for first conversion then then.</p>

No.	Marking Scheme	Marks	Comments
13.	Radius of circle = $\frac{3.5}{\sin 30^\circ} = 7 \text{ cm}$	B1	Radius of a circle 7 cm seen (diagram or calculated) B1 or used.
	Area of major sector = $\frac{300}{360} \times 7 \times 7 \times \frac{22}{7}$ $= 128\frac{1}{3} \text{ cm}^2$	M1	 Follow through.
	Area of triangle = $\frac{1}{2} \times 7 \times 7 \sin 60$ $= 21.22 \text{ cm}^2$		Area of circle - Area of the minor segment $\pi r^2 -$
	Area of major segment $= 128\frac{1}{3} + 21.22$ $= 149.55 \text{ cm}^2$	M1 A1 4	$\frac{22}{7} \times 7^2 = 154$ $\frac{60}{360} \times \frac{22}{7} \times 7^2 - \frac{1}{2} \times 7 \times 7 \times \sin 60$ $154 - 4.387 \text{ m m}$ $= 149.55$ for π accept 149.50 or 3.142 accept 149.52
14.	$h = 6.4 \tan 30^\circ = 3.7 \text{ m}$ Height of Electric pole = $3.7 + 2$ $= 5.7 \text{ m}$	M1 A1 2	 Tan $30^\circ = \frac{x}{6.4}$ Accept Scale drawing sin rule
	15.	Total time for relay $= 45 \text{ sec} + 43 \text{ sec} + 44 \text{ sec} + 45 \text{ sec}$ $= 2 \text{ min } 57 \text{ sec}$ Time race completed $1:35:31$ $+ 2:57$ $1:38:28 \text{ pm}$	M1 M1 A1 3

14 ALT 2 Sine rule ✓
 $\frac{6.4}{\sin 60} = \frac{h}{\sin 30}$ m/
 $h = 3.695 + 2$
 $= 5.7 \text{ A1}$

ALT 3
 scale drawing ✓
 B1 correct construction
 B1 accuracy
 $\pm 1^\circ, \pm 0.1 \text{ length}$



No.	Marking Scheme	Marks	Comments
16.	<p>(a)</p>  <p>(b) Oppositely congruent /</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>3</p>	<p>Award for the implied lines for correct image.</p> <p>For at least 2 correct</p> <p>$CM = MC'$, $BM = MB'$ $DM = MD'$, $AM = MA'$ (all at 90° to the mirror)</p> <p>Correct image $A'B'C'D'$ and labelled</p> <p>Accept indirectly congruent ✓ laterally inverted ✓</p>

if lost 2 B1 B1 for image but states the congruence ✓ it is B1 ✓

No.	Marking Scheme	Marks	Comments
17.	(a)(i) Kimani's contribution $= \frac{3}{8} \times \left(\frac{80}{100} \times 1\,750\,000 \right)$ $= \text{Ksh. } 525\,000$	M1 A1	A
	(ii) Ratio of contribution Koskei : Kimani : Atieno $= 350\,000 : 525\,000 : 875\,000$ $= 2 : 3 : 5$	M1 A1	ALT2 20% : 30% : 50% 2 : 3 : 5
	(b) Compound interest earned $= 1\,750\,000 \times 1.08^3 - 1\,750\,000$ $= \text{Ksh } 454\,496$	M1 A1	ALT3 : $\frac{2}{10} : \frac{3}{10} : \frac{5}{10}$ 2 : 3 : 5 Compound interest earned. ✓ 454,496 (1.08 ³ to 4 sf)
	Share received by each Koskei = $\frac{2}{10} \times \frac{90}{100} \times 454\,496$ $= \text{Ksh } 81\,809$	M1 A1	For $\frac{90}{100} \times 454\,496$ Accept 81900
	Kimani = $\frac{3}{10} \times \frac{90}{100} \times 454\,496$ $= \text{Ksh } 122\,714$	B1	Accept 122850
	Atieno = $\frac{5}{10} \times \frac{90}{100} \times 454\,496$ $= \text{Ksh } 204\,523$	B1	
		10	Accept 204750

ig ii) A1 is lost due to not simplified in ratio
the other As is A1 ✓

No.	Marking Scheme	Marks	Comments
18.	<p>(a) height of cone = $\sqrt{(10^2 - 6^2)}$ $= 8 \text{ cm}$</p> <p>Total height of solid = $8 + 15 + 6$ $= 29 \text{ cm}$</p> <p>(b) Surface area of solid = $\pi r l + 2\pi r h + 2\pi r^2$ $= 3.142 \times 6 \times 10 + 2 \times 3.142 \times 6 \times 15 + 2 \times 3.1432 \times 6^2$ $= 188.52 + 565.56 + 226.224$ $= 980.3 \text{ cm}^2$</p> <p>(c) Volume of solid = $\frac{1}{3}\pi r^2 h + \pi r^2 h + \frac{2}{3}\pi r^3$ $= \frac{1}{3} \times 3.142 \times 6^2 \times 8 + 3.142 \times 6^2 \times 15 + \frac{2}{3} \times 3.142 \times 6^3$ $= 301.632 + 1696.68 + 452.448$ $= 2450.8 \text{ cm}^3$</p>	<p>B1</p> <p>B1</p> <p>M1 M1 M1</p> <p>A1</p> <p>M1 M1 M1</p> <p>A1</p>	<p>Curved part of cone Curved part of cylinder hemisphere</p> <p>if 3.142 is not used A0 i.e.</p> <p>Volume of cone Volume of cylinder Volume of hemisphere</p> <p>Accept 2450.7 values to 4 s.f. lose A mark if 3.142 is not used.</p>
		10	

No.	Marking Scheme	Marks	Comments
19.	(a)(i) Time taken by lorry = $\left(\frac{180}{x}\right)$ hours	B1	
	Time taken by pickup = $\left(\frac{180}{x+20}\right)$ hours	B1	Accept $\frac{180}{x} - \frac{3}{4}$ Hrs.
	(ii) $\frac{180}{x} - \frac{180}{x+20} = \frac{45}{60}$ $\frac{180}{x} - \frac{180}{x+20} = \frac{3}{4}$	M1	
	$180(x+20) - 180x = \frac{3}{4}(x^2 + 20x)$	M1	
	$x^2 + 20x - 4800 = 0$	M1	
	$(x+80)(x-60) = 0$	M1	$x = \frac{-20 \pm 140}{2}$ m1 Must be equated to zero
	$x = 60$ or -80		As if this is given
	$x = 60$	A1	60 must be discriminated.
	Speed of lorry = 60km/h		
	Speed of pick up = 80km/h	B1	
	(b) Relative speed = 80 + 60 = 140 km/h		
	Time to meet = $\frac{240}{140}$ hours	M1	
= 1hr 43 min	A1	Accept 1hr 42 min 51 sec 0.71667 Hrs. 1.714285714 Hrs.	
Time the vehicles met = 8.30am + 1hr 43 min			
= 10.13 am	B1	Accept 10:12:51 am	
		10	

ALT 2

$$b) \frac{d}{80} = \frac{240-d}{60}$$

$$d = 137.14$$

$$T = \frac{137.14}{80} \text{ m1} = 1 \text{ hr } 43 \text{ min. A}$$

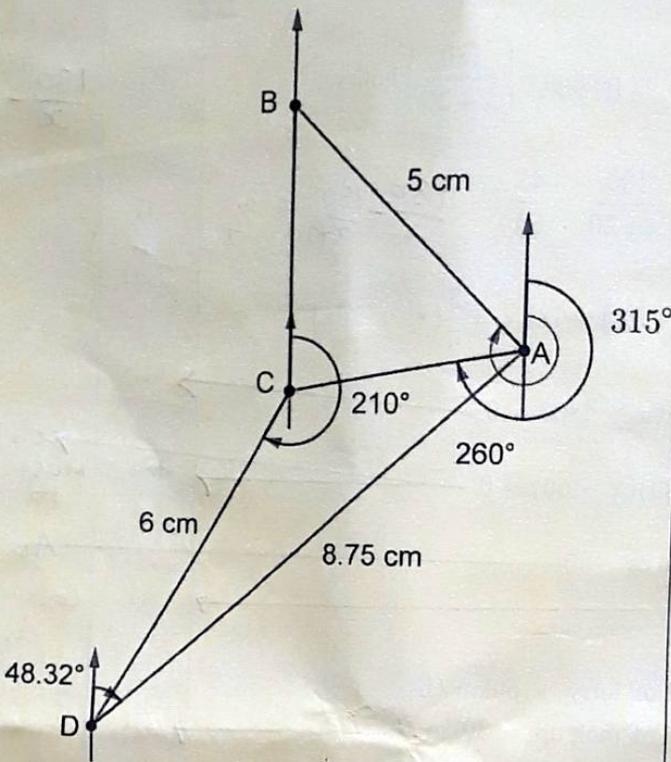
$$10.13 \text{ am B1}$$

$$t = 8.30$$

$$80(t - 8.30) + 60(t - 8.30) = 240 \text{ km}$$

$$80x + 60x = 240$$

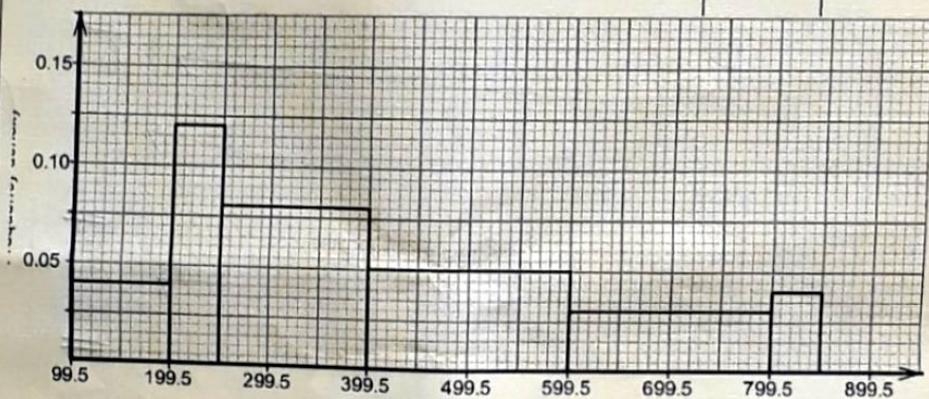
$$\frac{140x}{140} = \frac{240}{140}$$

No.	Marking Scheme	Marks	Comments
20.	<p>(a) 1 cm represents 5 km</p>  <p>(b)(i) Distance DA = (8.8 ± 0.1) cm $= (8.8 \pm 0.1) \times 5$ km $= 44 \pm 0.5$ km</p> <p>(ii) Bearing of A from D = 48 $\pm 1^\circ$ 048°</p> <p>(c) $AC = (3.6 \pm 0.1) \times 5$ km = 18 ± 0.5 km</p> <p>Area of the forest</p> $= \frac{1}{2} \times 18 \times 25 \sin 55^\circ + \frac{1}{2} \times 30 \times 18 \times \sin 130^\circ$ $= 184.3 + 206.8 \text{ m}^2$ $= 391.1 \text{ km}^2$	<p>B1 ✓ Location B B1 ✓ Location C B1 ✓ Location D</p> <p>M1 A1 B1 B1 M1 M1 A1</p> <p>10</p>	<p>✓ Location B ✓ Location C ✓ Location D</p> <p>if a different scale is used Mark and penalize MR - 2</p> <p>Conversion to km 44.5, 43.5 km Accept $N48^\circ E$</p> <p>Area of ACB Area of ADC Follow the</p>

c) y AB, BC are dotted / boundaries of the forest / any of the boundaries.
AD, DC the A mark is lost.

No.	Marking Scheme	Marks	Comments
21.	$(a)(i) \mathbf{AB} = \begin{pmatrix} 12 \\ -4 \end{pmatrix} - \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ $= \begin{pmatrix} 10 \\ -8 \end{pmatrix}$	M1 A1	Accept $\begin{pmatrix} -2 \\ -4 \end{pmatrix} + \begin{pmatrix} 12 \\ -4 \end{pmatrix}$ M1 $\begin{pmatrix} 10 \\ -8 \end{pmatrix}$ A1
	$(ii) \mathbf{ON} = \frac{1}{4}\mathbf{OB} = \frac{1}{4} \begin{pmatrix} 12 \\ -4 \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$	B1	M1B
	$\mathbf{M} \left(\frac{2+12}{2}, \frac{4+-4}{2} \right) = \mathbf{M}(7,0)$	M1 A1	
	$\mathbf{NM} = \begin{pmatrix} 7 \\ 0 \end{pmatrix} - \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ $= \begin{pmatrix} 4 \\ 1 \end{pmatrix}$	m1 M1 A1 M1	M1 for NM NB + BM $\frac{3}{4} \begin{pmatrix} 12 \\ -4 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} -10 \\ 8 \end{pmatrix}$ $\begin{pmatrix} 9 \\ -3 \end{pmatrix} - \begin{pmatrix} 5 \\ -4 \end{pmatrix} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ M1 A1
	$(iii) \mathbf{NM} = \sqrt{4^2 + 1^2}$ $= \sqrt{17} = 4.1$	M1 A1 M1	
	$(b) \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ -1 \end{pmatrix} - \begin{pmatrix} 2 \\ 4 \end{pmatrix} \quad \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 2 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$	M1	
	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$	M1	
	$\mathbf{OB}' = \begin{pmatrix} 12 \\ -4 \end{pmatrix} + \begin{pmatrix} 3 \\ -5 \end{pmatrix}$ $= \begin{pmatrix} 15 \\ -9 \end{pmatrix}$	A1	
	Coordinates of B' = (15, -9)		Must be ordered pair of coordinates
			10

No.	Marking Scheme	Marks	Comments																																										
22	<p>(a)</p> <table border="1"> <thead> <tr> <th>No. of Students</th> <th>100-199</th> <th>200-249</th> <th>250-399</th> <th>400-599</th> <th>600-799</th> <th>800-849</th> </tr> </thead> <tbody> <tr> <td>No. of schools</td> <td>4</td> <td>6</td> <td>12</td> <td>10</td> <td>6</td> <td>2</td> </tr> </tbody> </table> <p>(b)</p> <table border="1"> <thead> <tr> <th>No. of Students</th> <th>100-199</th> <th>200-249</th> <th>250-399</th> <th>400-599</th> <th>600-799</th> <th>800-849</th> </tr> </thead> <tbody> <tr> <td>No. of schools</td> <td>4</td> <td>6</td> <td>12</td> <td>10</td> <td>6</td> <td>2</td> </tr> <tr> <td>Class Width</td> <td>100</td> <td>50</td> <td>150</td> <td>200</td> <td>200</td> <td>50</td> </tr> <tr> <td>Frequency Density</td> <td>0.04</td> <td>0.12</td> <td>0.08</td> <td>0.05</td> <td>0.03</td> <td>0.04</td> </tr> </tbody> </table>	No. of Students	100-199	200-249	250-399	400-599	600-799	800-849	No. of schools	4	6	12	10	6	2	No. of Students	100-199	200-249	250-399	400-599	600-799	800-849	No. of schools	4	6	12	10	6	2	Class Width	100	50	150	200	200	50	Frequency Density	0.04	0.12	0.08	0.05	0.03	0.04	<p>B1</p> <p>B2</p> <p>B2</p> <p>B1</p>	<p>Any 4 ✓ or 5</p> <p>All ✓</p> <p>$FD = \frac{F}{CW}$</p> <p>All 6 FD ✓</p> <p>Any 4 FD ✓ or 5</p>
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if fd is not used but the correct histogram is seen the fd is implied.

(c)(i) Median class = 250 - 399

Let x = point where a vertical line dividing the area of histogram into two equal parts intersects the x axis

Then,

$$4 + 6 + (x - 249.5) \times \frac{12}{150} = \frac{1}{2} \times 40$$

$$x = 374.5$$

(ii) No. of schools with more than 350 students

$$= 2 + 6 + 10 + (399.5 - 350) \times 0.08$$

$$= 21.96$$

$$= 21 \text{ schools}$$

B2

B1

All 6 bars ✓ drawn

Any 4 bars ✓ or 5

M1

$$\frac{10}{0.08} + 249.5 \text{ m1}$$

$$= 374.5 \text{ A1}$$

A1

m1

$$50 \times 0.08 + 10 + 6 + 2 \text{ m1}$$

$$= 21 \text{ A1}$$

~~B1~~

A1

10

ALT at 350 = 4 + 6 + 8 = 18

above 350 = 40 - 18 = 22 m1

> = 21 B1 Page 12

No.	Marking Scheme	Marks	Comments
24.	(a) $\frac{ds}{dt} = 2t^2 - 7t - 6$ →	M1	
	When $t = 5$		
	$v = 2(5)^2 - 7(5) - 6$ →	M1	Correct substitution
	$= 9 \text{ m/s}$ →	A1	
	(b) $v = 0$ when particle is at rest		
	$2t^2 - 7t - 6 = 0$ →	M1	
	$t = \frac{7 \pm \sqrt{(49 - 4 \times 2 \times -6)}}{4}$		
	$t = \frac{7 \pm 9.849}{4}$ →	M1	
	$t = \frac{7 + 9.849}{4}$ or $t = \frac{7 - 9.849}{4}$		
	$t = 4.212 \text{ sec}$ or $t = \frac{-0.7123}{-1.425} \text{ sec}$		
	$t = 4.212 \text{ sec}$ →	A1	should be discriminated
	(c) Displacement of particle at $t = 4.212 \text{ sec}$		
	$s = \frac{2}{3} \times 4.212^3 - \frac{7}{2} \times 4.212^2 - 6 \times 4.212 + 8$ →	M1	✓ substitution
$s = -29.55 \text{ m}$ →	A1	Accept -29.54 (A8)	
(d) $a = \frac{dv}{dt} = 4t - 7$			
At $t = 4 \text{ sec}$			
$a = 4(4) - 7$ →	M1	Correct derivative and substitution	
$= 9 \text{ m/s}^2$ →	A1		
		10	

if b A mark is lost, # c) M0A0