

121/2 MS
 MATHEMATICS (Alt. A)
 Paper 2
 Oct/Nov 2015
 MARKING SCHEME

~~A.R.S.~~
 N.S.R.



THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

MATHEMATICS (Alt. A)
 Paper 2

MARKING SCHEME
 (CONFIDENTIAL)

THIS MARKING SCHEME IS THE PROPERTY OF THE KENYA NATIONAL EXAMINATION COUNCIL AND MUST BE RETURNED TO THE KENYA NATIONAL EXAMINATIONS COUNCIL AT THE END OF MARKING.

no marks for mistleup Statement
 mistle is applied to figures

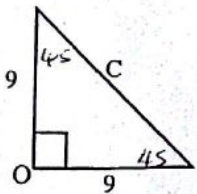
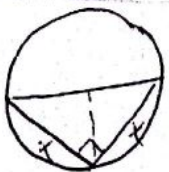
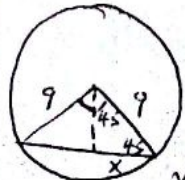
code - if there are unwanted things
 allow - if there are missing things
 ignore - if unwanted things - if
 This marking scheme consists of 15 printed pages

PA - is applied when the answer is given Turn over

$$\frac{75625 - 68425}{2}$$

$$AL = \text{Max Length} \times \text{actual width} - \text{Actual Length} \times \text{min width}$$

$$60.5 \times 12 - 60 \times 11.5 = 36$$

1.	<p>Actual area = 60×12</p> <p>= 720 cm^2</p> <p>Absolute error</p> <p>= $\frac{1}{2}[(60.5 \times 12.5) - (59.5 \times 11.5)]$</p> <p>= 36</p> <p>Relative error = $\frac{36}{720}$</p> <p>= 0.05</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>$\frac{0.5}{60}$</p> <p>$\frac{0.5}{12}$</p> <p>$\frac{0.5}{60} + \frac{0.5}{12}$ or $\frac{0.5+2.5}{60}$</p> <p>$0.05 \left \frac{1}{20} \right$</p>
2.	<p>$\frac{\sqrt{11}}{\sqrt{11}-\sqrt{7}} = \frac{\sqrt{11}(\sqrt{11}+\sqrt{7})}{(\sqrt{11}-\sqrt{7})(\sqrt{11}+\sqrt{7})}$</p> <p>= $\frac{11+\sqrt{77}}{4}$</p>	<p>M1</p> <p>A1</p> <p>2</p>	<p>Rationalizing denominator</p> <p>wait if brackets are not used</p>
3.	<p>$\frac{70}{360} \times 2 \times r \times \frac{22}{7} = 11$</p> <p>$r = \frac{11 \times 360 \times 7}{2 \times 22 \times 70}$</p> <p>= 9</p> <p>Length of chord</p> <p></p> <p>$C = \sqrt{9^2 + 9^2}$</p> <p>= 12.7 cm</p> <p></p> <p>$d = \frac{11}{22} \times \frac{360}{70}$</p> <p>$d = 18$</p> <p>$x^2 + x^2 = 18$</p> <p>$x = \sqrt{162}$</p> <p>$x = 12.7$</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>If the expression is in terms of D, wait until dividing the diameter by 2</p> <p>$D = 18$, $\frac{D}{2} = 9$</p> <p>$3.142 \times r = 9.002$</p> <p>$r = 9.004$</p> <p></p> <p>$\cos 45 = \frac{x}{9}$</p> <p>$x = 9 \cos 45$</p> <p>$x = 6.364$</p> <p>$2x = 12.728$</p> <p>$2x = 12.7$</p>

<p>Angle ACD = $180 - (90 + 55)$</p> <p>= 35° . . . At C or A</p> <p>Angle ACB = $180 - \overbrace{(90 + 35)}^{125} + 35$. . . $(55 - 35)$</p> <p>= 20° . . .</p>	<p>M1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>3</p>	<p>or from the diagram</p> <p>May be implied from the diagram</p>
<p>5. 1 person takes $24 \times 11 = 264$ h to do $\frac{3}{5}$ of the job.</p> <p>In 1 hour one person does $\frac{1}{264} \times \frac{3}{5} = \frac{3}{1320}$</p> <p>$\therefore$ 7 persons can do $\frac{3 \times 7}{1320}$ of the job in 1 hour $\frac{7}{440}$</p> <p>Time 7 persons take to complete $\frac{2}{5}$ of the job = $\frac{2}{5} \times \frac{1320}{21}$. . . or $\frac{2}{5} \times \frac{440}{7}$</p> <p>= <u>25.14 hours</u></p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>	<p>$24 \times \frac{2}{5} \times \frac{5}{3} = \frac{24 \times 2}{3}$</p> <p>Job ratio</p> <p>$24 \times \frac{11}{7}$ or $24 \times \frac{2 \div 3}{5 \div 5} = 24 \times \frac{2}{3} m$</p> <p>$24 \times \frac{11}{7} \times \frac{2}{5} \times \frac{5}{3}$ or $24 \times \frac{11}{7} \times \frac{2}{3} m$</p> <p>25.14 hrs . . .</p>
<p>6. $(3x + 12)^2 + (x - 4)^2 = 200^2$</p> <p>$9x^2 + 72x + 144 + x^2 - 8x + 16 = 40000$</p> <p>$\times 10x^2 + 64x - 39840 = 0$</p> <p>$(x - 60)(5x + 332) = 0$ $x = -64$</p> <p>$x = 60$ cm</p> <p>Area = $56 \times 192 = 10752$ cm^2</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>4</p>	<p>$\sqrt{3x + 12 + (x - 4)^2} = 200$</p> <p>(if wrong quadratic equation but correct attempt to solve)</p> <p>$x =$</p> <p>Accept 60 or -66.4 (without discriminant)</p>

$$\log_{10} \left(\frac{25(3x+2)}{(x-1)} \right) = 2 \quad /m \quad \frac{75x+50}{x-1} = 100$$

$$\log_{10} \left(\frac{75x+50}{x-1} \right) = 2$$

$$\log(3x+2) + \log 25 - \log(x-1)$$

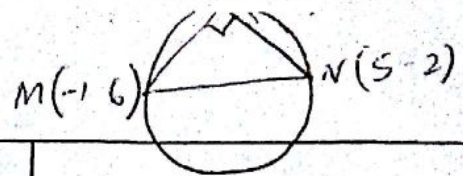
$$\log \left(\frac{25(3x+2)}{(x-1)} \right) = 2$$

7.	$\log(x-1) + \log 100 = \log(3x+2) + \log 25$ $\log_{100}(x-1) = \log_{25}(3x+2) \dots \dots$ $(x-1)100 = (3x+2)25$ $100x - 100 = 75x + 50$ $100x - 75x = 100 + 50 \dots \dots$ $25x = 150$ $x = 6$	$M1$ $M1$ $M1$ $A1$ 3	Collecting terms of x on
8.	$(x-y)^5 = x^5 - 5x^4y + 10x^3y^2 - 10x^2y^3 + 5xy^4 - y^5 \dots$ $9.8^5 = (10 - 0.2)^5$ $\left\{ \begin{aligned} &= 10^5 - 5(10)^4 \times 0.2 + 10 \times 10^3 \times 0.2^2 - \\ &10 \times 10^2 \times 0.2^3 + 5 \times 10 \times 0.2^4 - 0.2^5 \end{aligned} \right\}$ $= 90392.0797$	$B1$ $M1$ $A1$ 3	May be implied at the Substitution NB $M1$ can be earned even if $B1$ was lost if at least 4 terms are correct Substitution of at least 4 term CA:0

in case of reverse.

$$(y-x)^2 \dots \dots B0$$

then correct $x=10$
 $y=0.2$ } ignore the earlier B0
and give B1 M1



9.	<p>Centre of circle = $\left(\frac{-1+5}{2}, \frac{6+(-2)}{2}\right) \dots$ $= (2, 2)$</p> <p>Radius = $\frac{\sqrt{(-1-5)^2 + (6+2)^2}}{2}$ or equivalent $= \frac{\sqrt{36+64}}{2} = 5$</p> <p>Equation of circle = $= (x-2)^2 + (y-2)^2 = 5^2$ (May be independent from the first 2 marks) $= x^2 - 4x + 4 + y^2 - 4y + 4 = 25$ $= x^2 + y^2 - 4x - 4y = 17$</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>Grad MA $\frac{y-6}{x+1} \dots m_1$</p> <p>Grad NA $\frac{y+2}{x-5}$ or expression for $\frac{y+2}{x-5}$</p> <p>$\left(\frac{y-6}{x+1}\right)\left(\frac{y+2}{x-5}\right) = -1$</p> <p>$\frac{y^2 - 4y + 2}{x^2 - 4x - 5} = -1 \dots m_1$</p> <p>$y^2 - 4y + 2 = -x^2 + 4x + 5 \dots m_2$</p> <p>$x^2 + y^2 - 4x - 4y = 17 \dots A_1$</p>
----	---	--	---

10.	<p>⊥ bisector of AB</p> <p>Drawing circle centre X, radius 4 cm</p> <p>Locating P_1 and P_2 ($P_1P_2 = 6 \pm 0.1$ cm)</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>3</p>	<p>or Pythagoras</p> <p>$NA^2 + MA^2 = MN^2$</p> <p>Not necessary that perpendicular line is complete.</p> <p>Allow if other instruments are used</p> <p>For built</p>
-----	--	--	---

Q. D

11.	$\left(\frac{2}{3} \times \frac{3}{4}\right) \times 2$ $= \frac{11}{12} = \frac{25}{56} = 0.535714285$	M1 A1 2	
12.	$m + b \geq 32$ $m > 20$ $b \geq 0$ $2500m + 3500b \leq 100000$ $5m + 7b \leq 200$	B1 B1 B1 U1 4	if simplified must be simplified to the last bit
13.	$\int_1^4 (x^2 + 2x - 15) dx = \left[\frac{x^3}{3} + \frac{2x^2}{2} - 15x \right]_1^4$ $= \left[\frac{4^3}{3} + 4^2 - 15(4) \right] - \left[\frac{1^3}{3} + 1^2 - 15(1) \right]$ $= -22\frac{2}{3} - -23\frac{1}{3}$ $= \frac{2}{3} \text{ or } 0.\dot{6} \text{ or } 0.6\ldots$	M1 M1 A1 3	If limits are not put accept correct integration plus C At least 2 correct integrations correctly

divided by 1.853

$$\frac{32 \times 2 \times \frac{22}{7} \times 6310 \cos 45^\circ}{360} = 1485.49$$

$$\frac{2752.609564}{1.853} = 1485.5 \text{ M}$$

Convert
km to
nm
1.853

14.	<p>Longitude difference = $71 - 36 = 35^\circ$</p> <p>Distance in nautical miles</p> <p>$= 35 \times 60 \cos 45^\circ$</p> <p>$= 1484.9 \text{ nm}$</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>3</p>	<p>or 325°</p> <p>$325 \times 60 \cos 45$</p> <p>13788.6 nm</p>
15.	<p>$\sin\left(\frac{1}{2}x - 30\right) = \sin(90 - x)$</p> <p>$\frac{1}{2}x - 30 = 90 - x$</p> <p>$x = 80^\circ$</p>	<p>M1</p> <p>A1</p> <p>2</p>	<p>$\frac{x}{2} - 30 + x = 90^\circ$</p>
16.	<p>$PQ = \begin{pmatrix} 3 \\ -6 \end{pmatrix} + \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 5 \\ -5 \end{pmatrix}$ or $\begin{pmatrix} 2 \\ 1 \end{pmatrix} - \begin{pmatrix} -3 \\ 6 \end{pmatrix} = \begin{pmatrix} 5 \\ -5 \end{pmatrix}$</p> <p>$QR = \begin{pmatrix} 4 \\ -1 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$</p> <p>$PQ = \frac{5}{2} QR$ and Q is a common point</p> <p>$\therefore P, Q$ and R are collinear</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>3</p>	<p>1.853</p> <p>1485.5</p> <p>1485.5</p>

$$\text{Grad of } PQ = \frac{6-1}{-3-2} = -1$$

$$\text{Grad of } QR = \frac{-1-1}{4-2} = -1$$

PQ || QR

121/2 MS is common. hence,

P, Q, and R are collinear (not necessary)

Turn over

17. (a) (i) $6400 + 1750 \times 20$ $= \text{Ksh } 41\,400$ (ii) $41\,400 - 36\,000 = \text{Ksh } 5400$	M1 A1	⑥ $36000 \left(1 + \frac{r}{100} \times \frac{1}{12}\right)^{20} = 41400$
	A1 B1	$\left(1 + \frac{r}{1200}\right)^{20} = \frac{41400}{36000}$ $\left(1 + \frac{r}{1200}\right)^{20} = 1.15$
36000 $\left(1 + \frac{r}{100}\right)^{\frac{20}{3}} = 41400$ *	M1	$1.00702571 = 1 + \frac{r}{1200}$
$\left(1 + \frac{r}{100}\right)^{\frac{20}{3}} = 1.15$ or $\left(\frac{41400}{36000}\right)^{\frac{3}{20}}$	M1	$0.00702571 = \frac{r}{1200}$
$\left(1 + \frac{r}{100}\right) = 1.15^{\frac{3}{20}}$		$r = 8.415$ $r = 8.4\%$
Subst $\frac{r}{100} = 0.087473554$ or 0.0875 $r = 8.7473554$ or 8.8 $\approx 8.7\% \approx 8.8\%$	M1	$36000 \left(1 + \frac{r}{100}\right)^2 = 41400$
$36000 \left(1 + \frac{8.7}{100}\right)^2$	A1	$\left(1 + \frac{r}{100}\right)^2 = \frac{41400}{36000}$
(c) 36000×1.087^2	M1	$\left(1 + \frac{r}{100}\right)^2 = 1.15$
$= 42536.484$	M1	$1 + \frac{r}{100} = 1.00702571$
$42536.484 - 36000$	M1	$\frac{r}{100} = 0.00702571$
$= 6536.484 \approx \text{Ksh } 6536$ ✓ Nearest Shilling	A1 10	$r = 0.702571 \times 12$ $r = 8.4$

$$36000 \left(1 + \frac{8.8}{100}\right)^2$$

$$36000 (1.088)^2$$

$$36000 (1.183744)$$

$$42\,614.784$$

$$42\,614.784 - 36000$$

$$12\frac{1}{2} \text{ MS } = 6\,615 \text{ Nearest Shilling } 8$$

$$36000 \left(1 + \frac{8.4}{100}\right)^2$$

$$36000 (1.084)^2$$

$$36000 (1.175056)$$

$$42\,302.016$$

$$42\,302.016 - 36000$$

$$= 6\,302 \text{ Nearest Shilling}$$

18.	(a) (i) $40 + (10 - 1)(-3)$ $= 40 - 27 = 13 \text{ km}$	M1 A1	Allow Listing of the terms IF all of them are correct 13 13 is identified.
$a = 11$ $d = -2$ $n = 6$	(ii) First term after 10 days $= 13 - 2 = 11$ 16 th day: $11 + 5 \times (-2)$ $= 1 \text{ km}$	B1 M1 A1	or implied- $a = 13$ $b = -2$ $n = 7$ $13 + (6 \times (-2))$ $13 - 12$ $= 1 \text{ km}$
	(b) $S_{10} = \frac{10}{2}(2 \times 40 + 9 \times -3)$ $= 5(80 - 27) = 265$	M1	Allow Listing & adding
	$S_6 = \frac{6}{2}(2 \times 11 + 5 \times -2)$ $= 3(22 - 10) = 36$ Total distance travelled $= 265 + 36 = 301$	M1 A1	Listing then adding $\frac{1}{2}(26 + (6)(-2))$ $3.5\{26 - 12\}$ $3.5\{14\} = 49$ $49 - 13 = 36$
	Amount of money raised $= \text{Ksh } 301 \times 200$ $= \text{Ksh } 60\,200$	M1 A1	Any Allow if one of the m in b is earned.
		10	

Apply OW-1 if figures are rounded to more than one decimal place

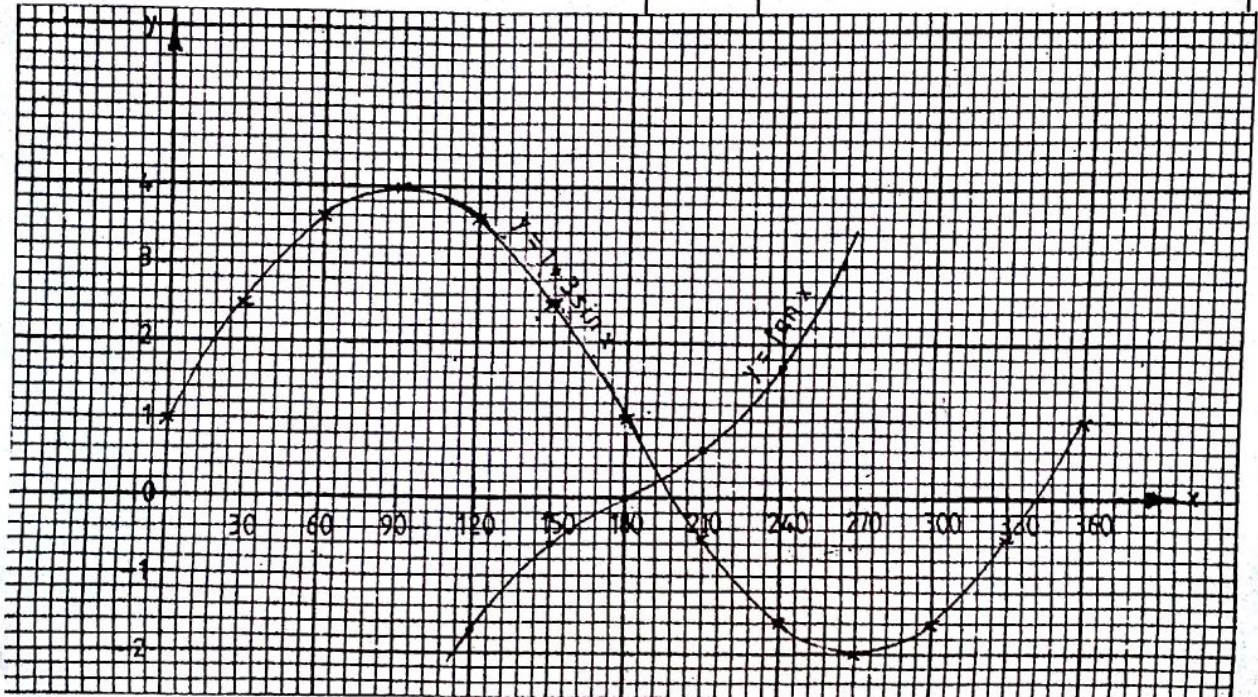
19. (a)

x°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$y = 1 + 3\sin x$	1	2.5	3.6	4	3.6	2.5	1	-0.5	-1.6	-2	-1.6	-0.5	1

B2

Allow B1 for at least 5 ✓

(b) (i)



(ii) Amplitude of curve = 3

(c) $\tan x$ values

x	90	120	150	180	210	240	270
$\tan x$		-1.7	-0.6	0	0.6	1.7	

Plotting $y = \tan x$

$\tan x$ curve

(d) $1 + 3 \sin x = \tan x$

$$x = \underline{195^\circ} \neq 2$$

S1

Sufficient & Linear

P1

Plotting (double tick) Can only be earned if a student earned a B1 in a

C1

B1

B1

May be implied from the $\tan x$ curve.

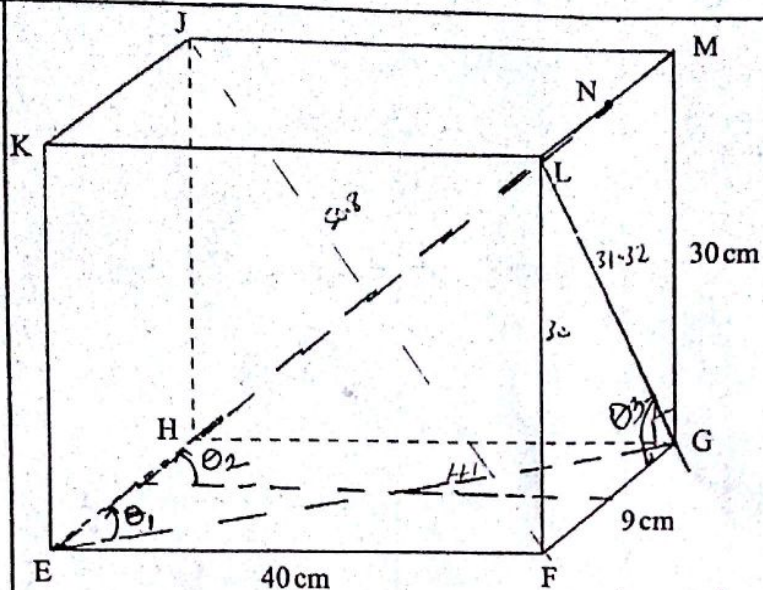
P1 - Correct plotting from 120° to 240°

C1 - Must be extended slightly beyond 120° & 240° beyond one small square.

B1

10

20.



(a) Length GL = $\sqrt{30^2 + 9^2} = \underline{31.32 \text{ cm}}$

(b) Length FJ = $\sqrt{40^2 + 9^2 + 30^2} = \underline{50.80 \text{ cm}}$

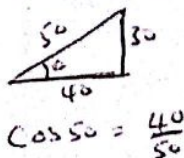
(c) angle between EM and plane EFGH

EG = $\sqrt{40^2 + 9^2} = \underline{41}$

$\tan \theta_1 = \frac{30}{41}$ $\theta_1 = \tan^{-1} \frac{30}{41}$ $\cos \theta =$
 $= 36.19^\circ$

(d) angle between the plane EFGH and ENH

$\tan \theta_2 = \frac{30}{40}$ $\theta_2 = \tan^{-1} \frac{30}{40}$
 $= 36.87^\circ$



$\cos 50 = \frac{40}{50}$

(e) angle between lines EH and plane GL

= angle between lines FG and GL

$\tan \theta_3 = \frac{30}{9}$ $\theta_3 = \tan^{-1} \frac{30}{9}$ $\cos \theta = \frac{9}{31.32}$
 $= 73.30^\circ$ $\theta = \frac{30}{9} = 73.30^\circ$

B1

M1

A1

B1

M1

A1

M1

A1

M1

A1

10

$\sqrt{40^2 + 9^2 + 30^2} = 50.8$

Can be implied.

$\cos \alpha = \frac{9^2 + 31.32^2 - 30^2}{2 \times 9 \times 31.32}$

$\alpha = 0.2873$

$\alpha = 73.30$

121/2 MS

$\theta = 73.31$
 $(= 73.32)$

Turn over

<p>21.</p> <p>(a) (i) $P = k_1 m^2 + k_2 n$</p> <p>$4k_1 + -3k_2 = 3.8$</p> <p>$9k_1 + 2k_2 = -0.2$</p> <p>$\begin{cases} 8k_1 - 6k_2 = 7.6 \\ 27k_1 + 6k_2 = -0.6 \end{cases}$</p> <p>$35k_1 = 7.0$</p> <p>$k_1 = 0.2 \left\{ \frac{1}{5} \right.$</p> <p>$k_2 = -1 \left. \right\}$</p> <p>$\therefore P = 0.2m^2 - n$ or $P = \frac{1}{5}m^2 - n$</p> <p>(ii) $P = 0.2 \times 10^2 - 4 = 16$</p> <p>(c) $0.2 m^2 = P + n$ (M on its own side)</p> <p>$m = \sqrt{\frac{P+n}{0.2}}$ or $m = \sqrt{5(P+n)}$</p> <p>New $m_1 = \sqrt{\frac{1.1(P+n)}{0.2}}$</p> <p>% increase in $m_1 = \frac{(\sqrt{1.1} - 1) \sqrt{\frac{P+n}{0.2}}}{\sqrt{\frac{P+n}{0.2}}} \times 100$</p> <p>$= 4.88\%$</p> <p>Allow for 4.9%</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>10</p>	<p>may be implied in two equations that follow.</p> <p>Attempt to solve</p> <p>16</p> <p>1</p>
--	---	--

Allow if
is omitted

✓ B

F part a
is wrong
last c is
automatically
wrong.

22. (a) V in terms of t

$$V = \frac{dy}{dt} = 9 - 3t \quad V = \int (9 - 3t) dt$$

$$V = 9t - \frac{3t^2}{2} + C$$

when $t = 0, V = 7 \Rightarrow$

$$7 = 9(0) - \frac{3}{2}(0)^2 + C$$

$$\therefore V = 9t - \frac{3t^2}{2} + 7$$

(b) maximum velocity

$$\Rightarrow a = 9 - 3t = 0 \Rightarrow t = 3$$

$$\therefore V = 9 \times 3 - \frac{3 \times 9}{2} + 7 \quad \text{Substituting}$$

$$= 27 - \frac{27}{2} + 7$$

$$= 34 - 13.5$$

$$= 20.5 \text{ ms}^{-1}$$

$$(c) S = \int_0^3 (9t - \frac{3}{2}t^2 + 7) dt$$

$$\left[\frac{9t^2}{2} - \frac{3t^3}{6} + 7t \right]_0^3 \quad \text{or} \quad \left[4.5t^2 - \frac{t^3}{2} + 7t \right]_0^3$$

$$\left[\frac{81}{2} - \frac{3 \times 27}{6} + 21 \right] - [0] \quad \text{Substituting}$$

$$= 27 + 21$$

$$= 48 \text{ m}$$

B1

M1

M1

A1

B1

M1

A1

M1

M1

A1

10

B1 may be implied.

may be implied

$$\boxed{\text{just } 9t - \frac{3t^2}{2} + 7}$$

$$t = 3 \quad \checkmark \text{ B1.}$$

Allow if two forms of integration are ~~either~~ substitutedIf no Limits Constant should be there i.e.

$$\frac{9}{2}t^2 - \frac{3}{6}t^3 + 7t + C$$

Allow even if zero not substituted.
 - Allow if two forms are correct

NB If Limits or Constants are absent just mark and award omission of work over.

23. (a) Lower class boundary of modal class
62.5

(b) Mean mark: 63

$\Sigma fd = -42 + -36 + -40 + 12 + 48 + 33 = -25$

$\therefore \text{mean} = 64 - \frac{25}{40} = 63.375$
63.38

(c) (i)

Cummulative frequency	3	7	17	29	37	40
Upper class boundary	52.5	57.5	62.5	67.5	72.5	77.5

B1

M1

M1

A1

B1

B1

P1

C1

B1

M1

A1

10

Allow for at least 4 correct deviations sum up

C.f may be implied from plotting.

(ii) $Q_3 = 68$ $Q_1 = 59$ both

Semi-interquartile range

$= \frac{68 - 59}{2}$

$= 4.5$

When lower limits are used in plotting P & C are - lost - But allow marks with small square.

→ Read quartiles from student's graph. Error acceptable within one small square.

24. (a)

$$\begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 4 & 2 & 1 \\ 1 & 1 & 3 & 3 \end{pmatrix} = \begin{pmatrix} 4 & 7 & 11 & 10 \\ 1 & 1 & 3 & 3 \end{pmatrix}$$

coordinates

$$K'(4,1), L'(7,1), M'(11,3), N'(10,3)$$

M1

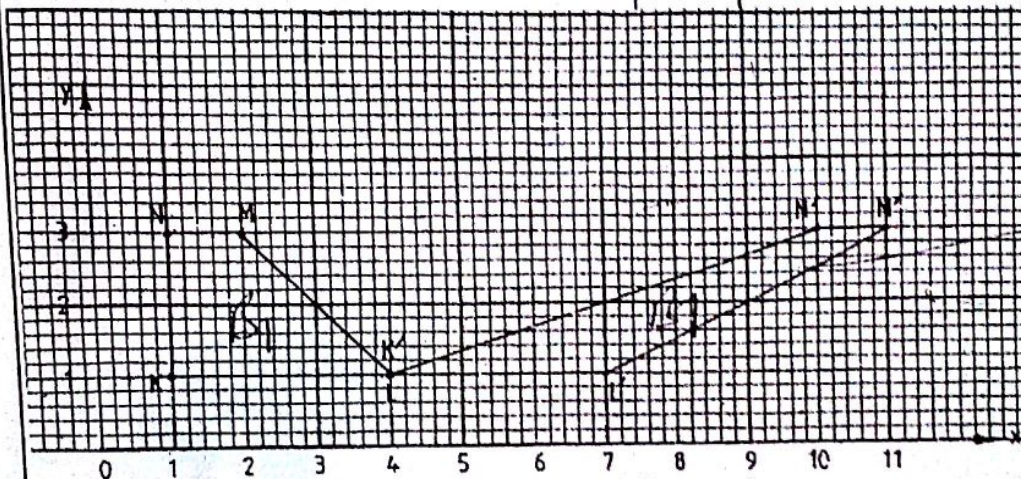
A1

If at least 2 point
correctly marked

All values correct

B1

(b)

Plotting 2
image point
is acceptable

B1

✓ object KLMN

B1

✓ image K'L'M'N'

B1

any other point and its image may
be usedC (i) shear with x axis ($y=0$) invariant

Shear factor 3
and point N(1,3), mapped onto N'(10,3)
M(2,3) → M'(11,3)

C (ii) area of image L(4,1) → L'(7,1)

$$= \left(\frac{3+1}{2} \right) \times 2 = 4$$

B1

NB you can describe the
transformation from
the matrix.

$$(d) T^{-1} = \frac{1}{1} \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$$

M1

A1

10

$$\begin{array}{rcl} 4a + b & = & 1 \\ 7a + b & = & 4 \\ \hline -3a & = & -3 \\ a & = & 1 \end{array} \quad \begin{array}{rcl} 4c + d & = & 1 \\ 7c + d & = & 1 \\ \hline -3c & = & 0 \\ c & = & 0 \end{array}$$

$$b = -3$$

$$d = 1$$

Shear factor 3.

121/2 MS X axis invariant

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 1 & 4 & 2 & 1 \\ 1 & 1 & 3 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 4 & 2 & 1 \\ 1 & 1 & 3 & 3 \end{pmatrix}$$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 1 & 4 & 2 & 1 \\ 1 & 1 & 3 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 4 & 2 & 1 \\ 1 & 1 & 3 & 3 \end{pmatrix}$$

attempt to solve simultaneous equations