MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education (K.C.S.E)

END TERM II EXAMINATIONS – 2019

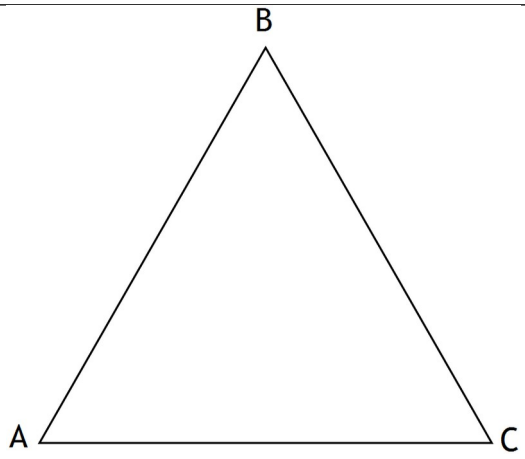
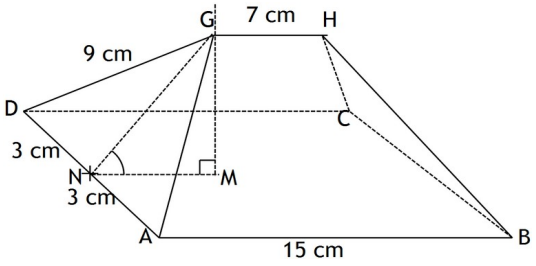
121/2 - MATHEMATICS ALT. A - Paper 2

MARKING SCHEME

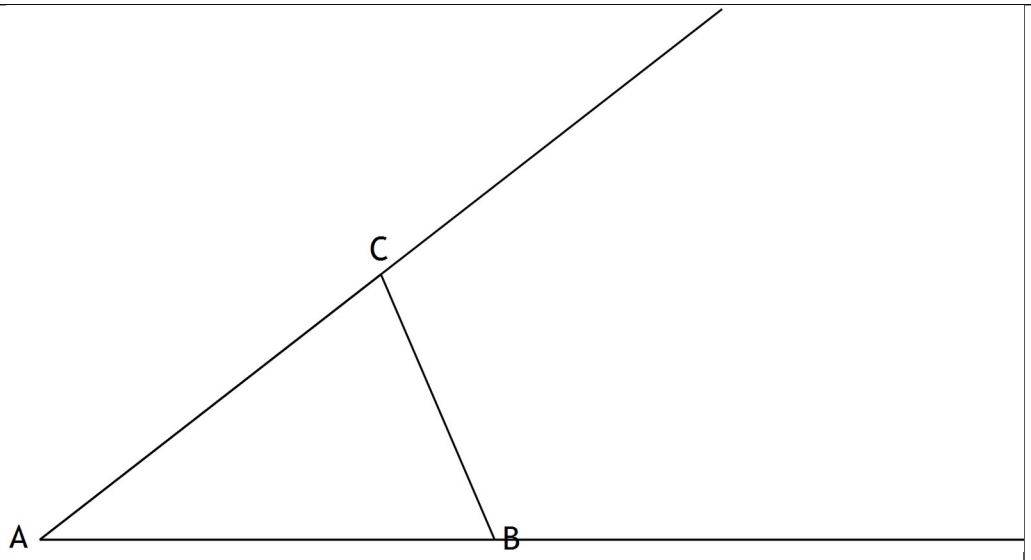
SECTION I (50 MARKS)			
S/ NO.	**WORKING**	**MARKS**	**COMMENTS**
1.	$\sqrt{\dfrac{12\log 2}{1+\left\{\log\left(\dfrac{16}{100}\right)\right\}^{\frac{1}{2}}+\log 8^{\frac{1}{3}}}}$ $\sqrt{\dfrac{12\log 2}{1+(\log(\frac{16}{100}))^{\frac{1}{2}}+\log 8^{\frac{1}{3}}}}=\sqrt{\dfrac{12\log 2}{1+2\log 2-1+\log 2}}$ $=\sqrt{\dfrac{12\log 2}{3\log 2}}=\sqrt{4}=2$	M1 M1 A1	✓ numerator ✓denominator Accuracy
		03	
2.	$\dfrac{\sqrt{2}(\sqrt{2}+\sqrt{3})-\sqrt{3}(\sqrt{2}-\sqrt{3})}{(\sqrt{2}+\sqrt{3})(\sqrt{2}-\sqrt{3})}$ $\dfrac{2\pm\sqrt{6}-\sqrt{6}+3}{2-3}$ $\dfrac{5}{-1}$ -5	M1 M1 A1	✓ rationalizing the denominator ✓Rationalized denominator Accuracy
		03	
3.	$\dfrac{f^2H}{d^2}=\dfrac{a^2-k}{H}$ $H^2=\dfrac{d^2(a^2-k)}{f^2}$ $H=\pm\sqrt{\dfrac{d^2(a^2-k)}{f^2}}$	M1 M1 A1	Squaring both sides Collecting terms in H together H made subject
		03	
4.	$\dfrac{7}{9}=0.77777777777\dot{7}$	M1	✓ Exp for Absolute error

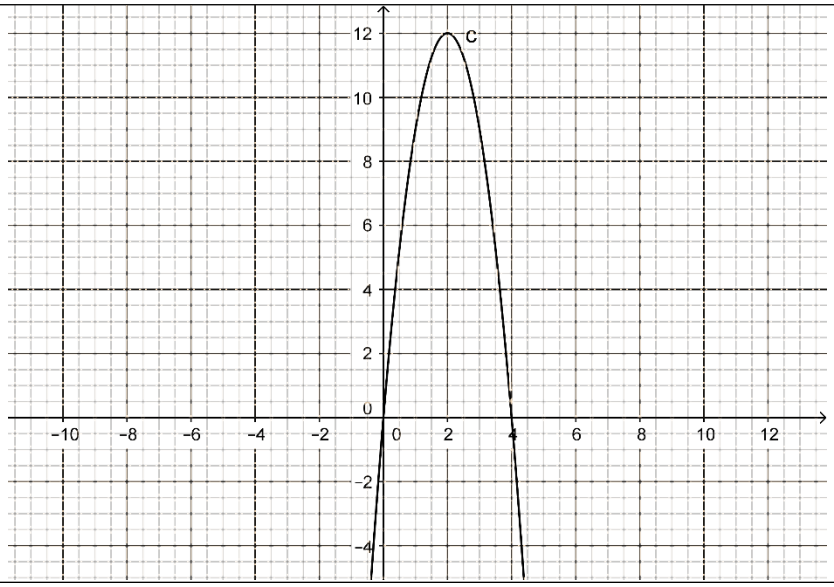
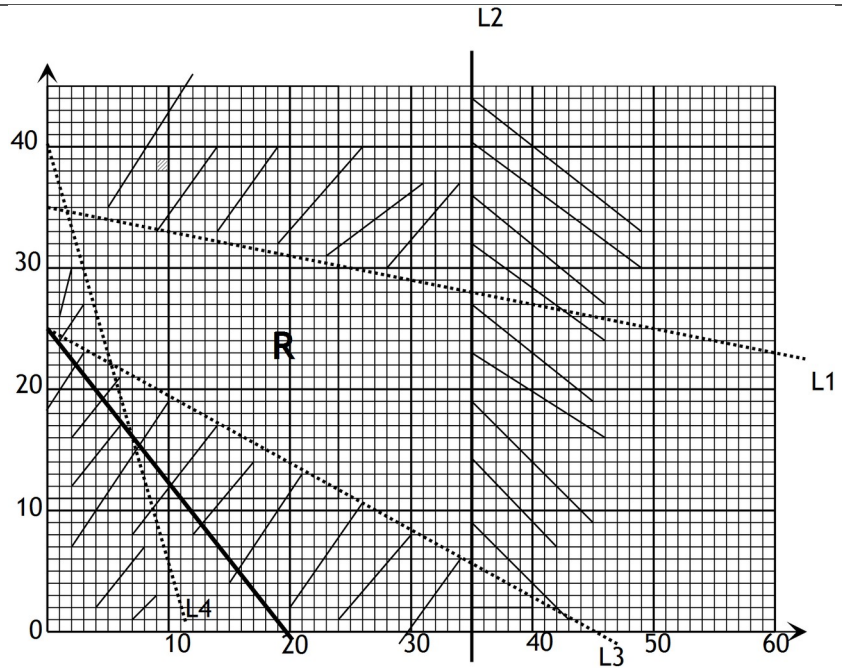
	Truncating to 3 d.p = 0.777 $\frac{777}{1000}$ Absolute error $=\frac{7}{9}-\frac{777}{1000}=\frac{7}{9000}$ $\%\,Error=\left(\frac{7}{9000}\div\frac{7}{9}\right)\times 100=\left(\frac{7}{9000}\times\frac{9}{7}\right)\times 100$ 0.1%	M1 A1	✓ Exp for % error
		03	
5.	$OP=\frac{5}{3}\begin{pmatrix}3\\1\end{pmatrix}+\frac{-2}{3}\begin{pmatrix}6\\-5\end{pmatrix}$ $OP=\frac{1}{3}\begin{pmatrix}15-12\\5+10\end{pmatrix}$ $OP=\begin{pmatrix}1\\5\end{pmatrix}$ $P(1,5)$	M1 A1 B1	√ expression for OP Column vector OP Coordinates of P
		03	
6	$x+2y=-1$ $\quad 2x+4y=2$ $2x+3y=3$ $\quad 2x+3y=3$ $y=5$ $x=9$ $R(9,-5)$ $2^2=(x-a)^2+(y-b)^2$ $5^2=(x-9)^2+(y+5)^2$ $25=x^2-18+81+y^2+10y+25$ $\Rightarrow x^2+y^2-18x+10y+81=0$	M1 A1 M1 A1	Solving the two simultaneous equations Both values of x and y ✓Substitution into circle equation ✓format
		04	
7.	In 1min the three taps fills $\frac{1}{5}+\frac{1}{3}-\frac{4}{15}$ of the bath $\frac{4}{15}$ of the bath After $1\frac{1}{2}$ min $\left(\frac{3}{2}x\frac{4}{15}\right)$ of the bath filled = $\frac{2}{5}$ is filled Fraction remaining after $1\frac{1}{2}$ mins = $\frac{3}{5}$ of the bath. H and C fills $\left(\frac{1}{5}+\frac{1}{3}\right)=\frac{8}{15}$ of the bath in 1 minute	M1 M1 M1	✓exp for fraction filled by the 3 taps ✓exp for fraction filled after $1\frac{1}{2}$min

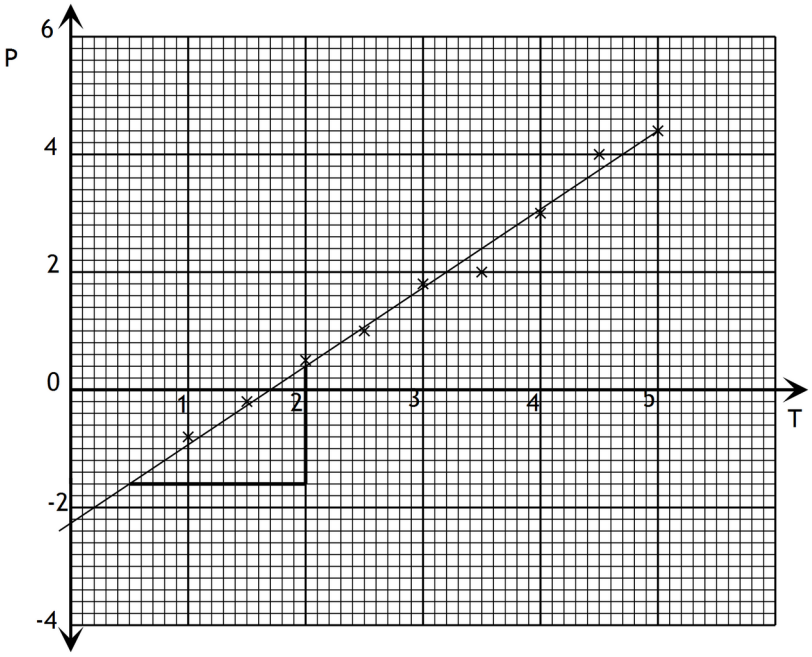
	If $\frac{8}{15}$ is filled by H & C in 1 min $\therefore \frac{3}{5} \Rightarrow \frac{3}{5} \times \frac{15}{8} \times 1$ $1\frac{1}{8}\text{min}$	A1	
		04	
8.	$P = kQ + \frac{m}{Q^2}$ $7 = k + m$ $7 = 2k + \frac{m}{4} \Rightarrow 28 = 8k + m$ $\therefore 21 = 7k$ $k = 3$ $m = 4$ $P = 3Q + \frac{4}{Q^2}$ $P = 3 \times \frac{2}{3} + \frac{4}{\left(\frac{2}{3}\right)^2}$ $P = 11$	B1 M1 A1	Both values of constants ✓Substitution of constants into equation of P Accuracy
		03	
9	a) ∠SRQ = $180 - (45 + 30) = 105^0$ b) ∠TRS = 45^0 c) ∠SPQ = 75^0 d) ∠PSR = 30 + 52.5 = 82.5^0	B1 B1 B1 B1	
		04	
10	$x^5 + 5x^4\left(\frac{3}{x}\right) + 10x^3\left(\frac{3}{x}\right)^2 + 10x^2\left(\frac{3}{x}\right)^3 + 5x\left(\frac{3}{x}\right)^4 + \left(\frac{3}{x}\right)^5$ $x^5 + 15x^3 + 90x + \frac{270}{x} + \frac{405}{x^3} + \frac{243}{x^5}$ $\left(10 + \frac{3}{10}\right) = \left(x + \frac{3}{x}\right) = x = 10$ $10^5 + 15 \times 10^3 + 90(10) + \frac{270}{10}$ 115927	B1 M1 A1	Accept $270x^{-1} + 405x^{-3} + 243x^{-5}$ ✓expansion ✓substitution Accuracy
		03	

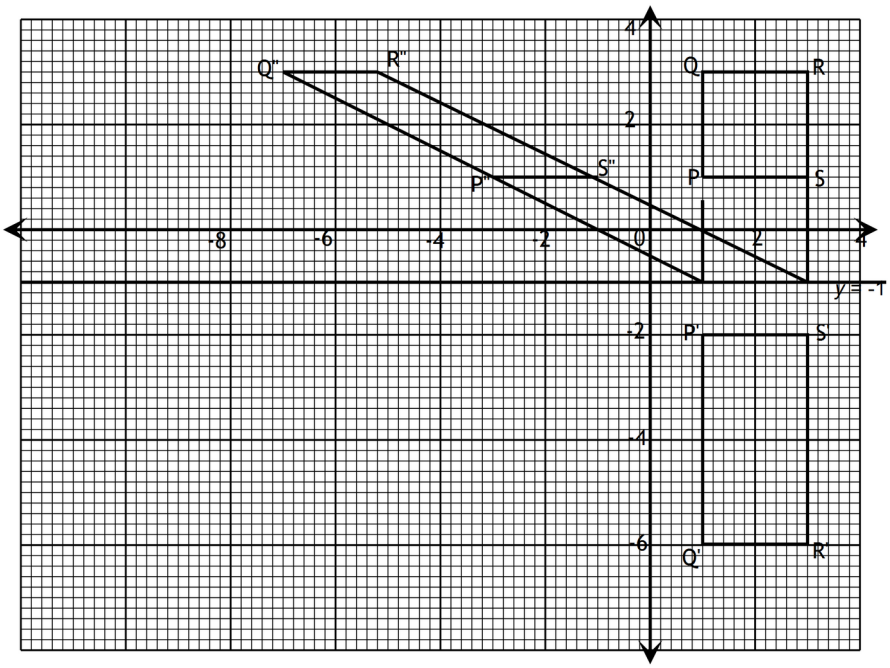
11	$8(1-\cos^2 x)+2\cos x-7=0$ $8\cos^2 x-4\cos x+2\cos x-1=0$ $4\cos x(2\cos x-1)+1(2\cos x-1)=0$ $(2\cos x-1)(4\cos x+1)=0$ $\cos x=1/2 \text{ or } \cos x=-1/4$ $x=60°, 104.5°, 255.5° \text{ and } 300°$	M1 M1 A1 B1	✓rewriting into equation with one trig. ratio ✓factorisation Accuracy All angles stated
		04	
12		B1 B1 B1	arc 4.5cm from A inside triangle and ⊥ bisector of BC Line 3cm from BC (parallel) and inside triangle ✓Shaded region
		03	
13	GN=$\sqrt{81-9}$ $\sqrt{72}$ 6$\sqrt{2}$ cm or 8.48853cm ✓  NM= $\frac{15-7}{2}cm=4cm$ ✓ $\cos\theta=\frac{4}{8.4853}$ $\theta=\cos^{-1}0.4714$ $\theta=61.87^0$ ✓	M1 M1 A1	Expression for length GN Expression for angle Angle
		03	

B

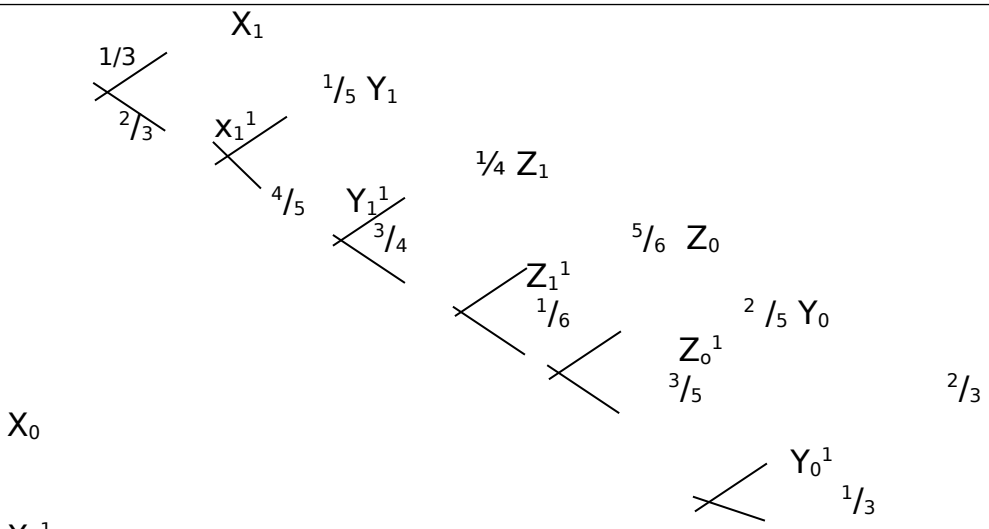
14		B1 B1 B1 **03**	✓ ly determining the centre by bisecting ∠C and ∠B ✓ ly determining the radius by dropping a ⊥ from centre to one of the sides ✓ ly drawn circle.
15	$y=12x-3x^2$ $0=-3x^2+11x-4$ $y=x+4$ $x=0.5\pm0.25$ *or* $x=3.5\pm0.25$	B1 L1 B1	Linear eqn Line y = x + 4 correctly drawn Both solutions

			
		03	
16	 $5x+4y=k$ $y=-\frac{5}{4}x+k$	B1 B1 B1 Minimum value	Search line with gradient $\frac{-5}{4}$ drawn Maximum value $x=35, y=27$ $x=6, y=22$
		03	
	SECTION II (80 MARKS)		
17	**a)i)** $a=0.5m, l=15m, d=0.25m$ $15=0.5+(n-1)0.25$ $n=59 pieces$ $(ii)\ a+9d$ $0.5+(9\times 0.25)$ $2.75m$	M1 A1 M1 A1 M1	✓Substitution into formula Accuracy ✓substitution Accuracy ✓substitution

b)	$\frac{n}{2}[a+l]=\frac{59}{2}(0.5+15)$ iii) $=457.25m$ $s_n=\frac{n}{2}[2a+(n-1)d]$ $63=\frac{n}{2}[(2\times0.5)+(n-1)0.25]$ $63=\frac{n}{2}(1+0.25n-0.25)$ $0.25n^2+0.75n=126$ $n^2+3n-504=0$ $n=\frac{-3\pm\sqrt{3^2-4\times1\times-504}}{2\times1}$ $n=\frac{-3\pm45}{2}$ $n=-24\ or\ 21$ $\therefore n=21\ pieces$	A1 M1 M1 M1 A1	Accuracy ✓substitution ✓quadratic equation formed ✓attempt to solve quad. Eqn Accuracy after discriminating ve value
		10	
18	a)  **b)i)**	S1 P1 L1 B1 M1 A1 B1 B1	Linear scale Plotting all points Line of best fit

	$r=gradient=\frac{\Delta P}{\Delta T}=\frac{0.4--1.6}{2-0.5}$ $r=\frac{2}{1.5}$ $r=1.333$ **ii)** y –intercept = -2.2 ± 0.1 **c)i)** $P=1.333T-2.2$ $P=1.333\times0.3-2.2$ **ii)** -1.8001	M1 A1	
		10	
19	a)i)  **ii)** stretch x-axis invariant/parallel to y- axis stretch factor -2 **iii)** $\begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}1 & 1\\ 1 & 3\end{pmatrix}=\begin{pmatrix}1 & 1\\ -2 & -6\end{pmatrix}$ $a+b=1, c+d=-2$ $a+3b=1, c+3d=-6$ $b=0, a=1, d=-2, c=0$ $T=\begin{pmatrix}1 & 0\\ 0 & -2\end{pmatrix}$	B1 B1 B1 B1 B1 M1 A1 B1 B1 B1	PQRS drawn correctly P′ Q′ R′ S′ under T. invariant line y = -1 drawn correctly Q'' correctly located P'' and S''

	b) SEE THE GRAPH ABOVE		correctly located & completion.
		10	
20	**a) i)** $longitudinal\ diff = 16+16 = 32$ $Dist = 32 \times 60 \cos 34$ $= 1591.75$ $\lesssim 1592 nm$ 60×60 **ii)** $3600 nm$ **b)i)** $1^0 = 4 \min$ $32^0 = \frac{32 \times 4}{1} = 128 \min = 2 hrs\ 8 \min$ $1330h + 2h\ 8 \min$ $1538h$ ii) $t = \frac{1592}{40} = 38.9 hrs = 38h\ 48 \min$ $1538h + 38h\ 48 \min$ $Wednesday\ 0626h$	B1 M1 A1 M1 A1 M1 A1 M1 M1 A1	Long. diff Mult. Mult.
		10	
21.	**a)** $\frac{y-7}{x-0} = -1$ $y = -x+7$ **b)** $x^2 - 2x + 14 = -x + 7$ $x^2 - x - 2 = 0$ $(x+1)(x-2) = 0$ $x = -1, x = 2$ $P(-1,8)$ $Q(2,5)$	M1 A1 M1 M1 A1 B1	

	c) $trapezium = \frac{1}{2} \times 3(8+5) = 19.5 sq.units$ $\int_{-1}^{2} (x^2 - 2x + 5)dx$ $\left[\frac{x^3}{3} - x^2 + 5x + c\right]_{-1}^{2}$ $\left(\frac{8}{3} - 4 + 10\right) - \left(\frac{-1}{3} - 1 - 5\right) = 15 sq.units$ $shaded = 19.5 - 15$ $4.5 sq.units$	M1 M1 M1 A1	
		10	
22.	 	M1	
	a) $P(Z_{IN})\ or\ P(Z_{OUT})$ $\left(\frac{2}{3} \times \frac{4}{5} \times \frac{1}{4}\right) + \left(\frac{2}{3} \times \frac{3}{5} \times \frac{1}{6}\right)$ $¿\frac{2}{15} + \frac{1}{15}$ $¿\frac{3}{15} = \frac{1}{5}$	A1 M1 A1	
	b) $P(Y_{OUT})$ $\frac{2}{3} \times \frac{4}{5} \times \frac{3}{4} \times \frac{1}{3} \times \frac{2}{5}$ $\frac{4}{75}$	M1M A1	
	c)		

	$\frac{2}{3}\times\frac{4}{5}\times\frac{3}{4}\times\frac{1}{3}\times\frac{3}{5}\times\frac{1}{6}$ $\frac{1}{75}$ d) $P(Z_{OUT})orP(Y_{OUT})orP(X_{OUT})$ $\left(\frac{2}{3}\times\frac{4}{5}\times\frac{3}{4}\times\frac{2}{3}\right)+\left(\frac{2}{3}\times\frac{4}{5}\times\frac{3}{4}\times\frac{1}{3}\times\frac{2}{5}\right)+\left(\frac{2}{3}\times\frac{4}{5}\times\frac{3}{4}\times\frac{1}{3}\times\frac{3}{5}\times\frac{1}{6}\right)$ $\frac{4}{15}+\frac{4}{75}+\frac{2}{75}$ $\frac{26}{75}$	M1 M1 A1	
		10	

23.

(a)(i) *Amount of @ instalment*

$\frac{120}{100} \times 27\,000 = Kshs.\ 32\,400$

$\frac{32\,400 - 6\,000}{15} = \frac{26\,400}{15} = Kshs.\ 1\,760$

(ii) *Annual interest rate*

Amount= Total Instalment → *Kshs*.26 400

Principle → $C.P - D = 27\,000 - 6\,000 = Kshs.\ 21\,000$

$26\,400 = 21\,000\left(1 + \frac{r}{100}\right)^{15}$

$\left(1 + \frac{r}{100}\right) = \left(\frac{26\,400}{21000}\right)^{\frac{1}{15}} = 1.015373073$

$\frac{r}{100} = 1.015373073 - 1 = 0.015373073$

$r = 0.015373073 \times 100 = 1.5373073\%\ p.m$

Annual Rate → $1.5373073 \times 12 = 18.4476876\%\ p.a$

(b) *Annual Interest Rate in PLAN B*

Amount= Total Instalment → $20 \times 1680 = Kshs.\ 33\,600$

$33\,600 = 27\,000\left(1 + \frac{r}{100}\right)^{20}$

$\left(1 + \frac{r}{100}\right) = \left(\frac{33\,600}{27000}\right)^{\frac{1}{20}} = 1.010994459$

$\frac{r}{100} = 1.010994459 - 1 = 0.010994459$

$r = 0.010994459 \times 100 = 1.0994459\%\ p.m$

Annual Rate → $1.0994459 \times 12 = 13.1933508\%\ p.a$

(c) *Plan A is cheaper*

by $33\,600 - 32\,400 = Kshs.\ 1\,200$

10

24

x	15°	30°	45°	60^0	75°	90°	120°	150°	18

B1 Eight correct

(a)

									0°
$y = 3\sin(2x + 30^\circ)$	**2.60**	3.00	**2.60**	**1.50**	0.00	**-1.50**	-3.00	**-1.50**	1.50
$y = \cos 2x$	**0.87**	**0.50**	0.00	**-0.50**	**-0.87**	-1.00	**-0.50**	0.50	**1.00**

B2 values

B2 All values correct

(b)

SEE GRAPH BELOW

S1

P1 Use of given scale

C1 All pnts of 1st

P1 graph plotted correct

C1 1st wave smoothly drawn

(c) All pnts of 2nd

B1 graph plotted

B1 correct

(d) $x = 84 \pm 3^0$ *and*

(i) $x = 174 \pm 3^0$

B1 2nd wave smoothly drawn

(ii) 3 units

180^0

B1 Correct values of x

Correct amplitude

Correct period

10