

GATUNDU SOUTH FORM FOUR
EVALUATION EXAMINATION 2018
MATHEMATICS PAPER 2 ALT. A.
MARKING SCHEME

<u>SECTION I</u>	
1. $\frac{6}{\sqrt{5}+\sqrt{3}} - \frac{4}{\sqrt{5}-\sqrt{3}}$ $= \frac{6(\sqrt{5}-\sqrt{3}) - 4(\sqrt{5}+\sqrt{3})}{(\sqrt{5}+\sqrt{3})(\sqrt{5}-\sqrt{3})}$ $= \frac{6\sqrt{5} - 6\sqrt{3} - 4\sqrt{5} - 4\sqrt{3}}{5 - \sqrt{15} + \sqrt{15} - 3}$ $= \frac{2\sqrt{5} - 10\sqrt{3}}{5-3}$ $= \frac{2\sqrt{5} - 10\sqrt{3}}{2} = \sqrt{5} - 5\sqrt{3}$	m1 m1 A1
2. $3(3-x) < 5x-9 \leq 2x+8$ $3(3-x) < 5x-9$ $9-3x < 5x-9$ $9+9 < 5x+3x$ $\frac{18}{8} < \frac{8x}{8}$ $2\frac{1}{4} < x$ $5x-9 \leq 2x+8$ $5x-2x \leq 9+8$ $\frac{3x}{3} \leq \frac{17}{3}$ $x \leq 5\frac{2}{3}$ $2\frac{1}{4} < x \leq 5\frac{2}{3}$ Integral values are 3, 4, 5	m1 m1 m1 A1

3.	$\text{Log} \left(\frac{15^2}{x} \right) = \text{Log } 5(x-4)$ $\frac{15^2}{x} = 5x - 20$ $225 = 5x^2 - 20x$ $5x^2 - 20x - 225 = 0$ $x^2 - 4x - 45 = 0$ $(x-9)(x+5) = 0$ $x = 9 \text{ or } x = -5$ $\text{So } x = 9$	M1 A1
4.	$P(W) = \frac{5}{10}, P(B) = \frac{3}{9}, P(G) = \frac{2}{8}$ $= \frac{5}{10} \times \frac{3}{9} \times \frac{2}{8}$ $= \frac{1}{24}$	M1 A1
5.	$= (2x)^4 - 4(2x)^3(\sqrt{3}) + 6(2x)^2(\sqrt{3})^2 - 4(2x)(\sqrt{3})^3 + (\sqrt{3})^4$ $= 16x^4 - 32\sqrt{3}x^3 + 72x^2 - 24\sqrt{3}x + 9$	M1 M1 A1
6.	$a - b = \sqrt{b^2 + c^2}$ $(a-b)^2 = b^2 + c^2$ $a^2 - 2ab + b^2 = b^2 + c^2$ $a^2 - 2ab + b^2 - b^2 = c^2$ $a^2 - 2ab = c^2$ $\pm \sqrt{a^2 - 2ab} = c$	M1 M1 A1
7.	$\begin{aligned} \text{Amount borrowed (P)} &= 28000 - 8000 \\ &= 20000 \\ \text{New principal (A)} &= 15 \times 2000 \\ &= \text{sh. } 30000 \end{aligned}$	M1

	$30000 = 20000 \left(1 + \frac{r}{100}\right)^{15}$ $\frac{30000}{20000} = \left(1 + \frac{r}{100}\right)^{15}$ $1.5 = \left(1 + \frac{r}{100}\right)^{15}$ $1.0274 = 1 + \frac{r}{100}$ $r = 2.74\%$	M1 A1
8.	$\frac{2 \sin \left(x - \frac{\pi}{6}\right)^c}{2} = -\frac{\sqrt{3}}{2}$ $\sin \left(x - \frac{\pi}{6}\right)^c = -\frac{\sqrt{3}}{2}$ $\sin^{-1} \frac{\sqrt{3}}{2} = 60^\circ$ $\text{So } x - 30^\circ = 240^\circ \left(\frac{4}{3}\pi^c\right)$ $x = 270^\circ \left(\frac{3}{2}\pi^c\right)$ $\text{or } x - 30^\circ = 300^\circ \left(\frac{5}{3}\pi^c\right)$ $x = 300^\circ + 30^\circ = 330^\circ \left(\frac{11}{6}\pi^c\right)$ $\text{Ans } x = \frac{3}{2}\pi^c \text{ and } \frac{11}{6}\pi^c$ $= 1\frac{1}{2}\pi^c = 1\frac{5}{6}\pi^c$ $\frac{\pi}{6} = 30^\circ$ $3^{\text{rd}}, 4^{\text{th}}$ quad.	M1 M1 A1
9.	$\text{Det} = (4 \times 2) - (5 \times 1)$ $= 8 - 5 = 3.$ $\text{Area of image} = 3 \times 7$ $= 21 \text{ cm}^2.$	M1 M1 A1
10.	$A = \frac{1}{2} \times b \times h = 9$ $h = 3 \text{ cm}$	M1 B1 for R1 B1 for R2

$$11a) CD \times DE = AD \times DF.$$

$$4x = 5 \times 3.6.$$

$$x = \frac{5 \times 3.6}{4} = 4.5$$

B1

$$b) CB \times BE = AB^2.$$

$$16 \times 7.5 = AB^2$$

$$120 = AB^2$$

$$10.95 \text{ cm.} = AB$$

m1

A1

$$12a) 12.5 + 0.05 = 12.55$$

$$9.23 + 0.005 = 9.235$$

$$\text{Maximum difference} = 12.55 - 9.235$$

$$= 3.315 \text{ m.}$$

m1

A1

$$b) A-E \text{ in difference} = 0.05 + 0.005$$

$$= 0.055.$$

$$\text{Actual difference} = 12.5 - 9.23$$

$$= 3.27.$$

$$\% \text{ error} = \frac{0.055}{3.27} \times 100.$$

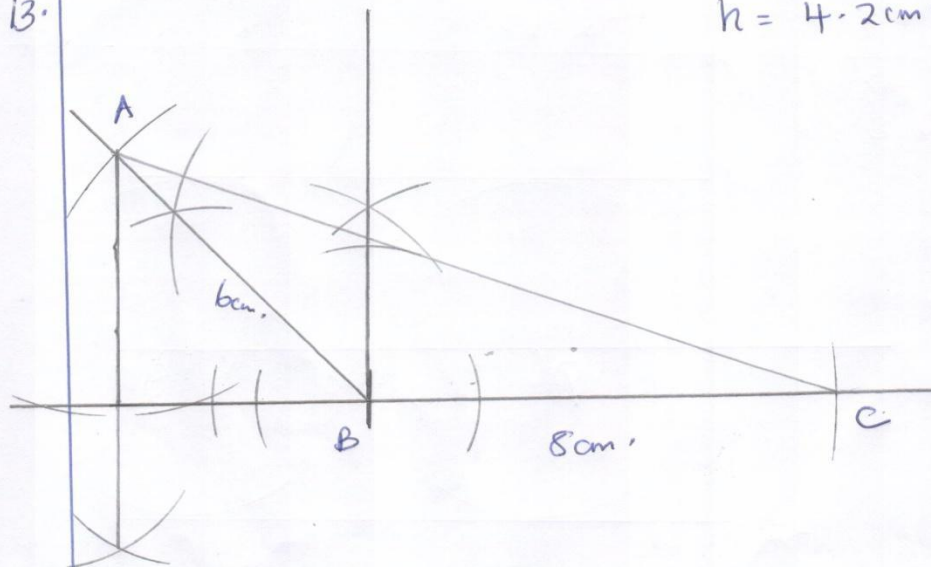
$$= 1.682\%.$$

m1

A1

13.

$$h = 4.2 \text{ cm.}$$



B1

135° - B1

Triangle - B1

Dropping - B1

Perpendicular

14. $\text{Mean} = \frac{45+52+54+55+57+57+62+66+448}{8} = 56$

d	-11	-4	-2	-1	1	1	6	10
d ²	121	16	4	1	1	1	36	100

Variance = $\frac{\sum d^2}{n} = \frac{280}{8} = 35$

S.D = $\sqrt{35} = 5.9$

M1

M1

A1

15a) $(0-3)^2 + (0-4)^2 = 25$
 $-3^2 + -4^2 = 25$
 $9 + 16 = 25$
 $25 = 25$

B1
Showing

b) $(x-3)^2 + (0-4)^2 = 25$
 $x^2 - 6x + 9 + 16 = 25$
 $x^2 - 6x = 0$
 $x(x-6) = 0$
 $x = 0$ or $x - 6 = 0$
 $x = 6$
 $(6, 0)$

M1

M1

A1

16. $P_1 = KQR^2$
 $P_2 = 1.5 \times 0.8^2 KQR^2$
 $P_2 = 0.96 KQR^2$
 $\frac{P_2 - P_1}{P_1} \times 100$
 $\frac{0.96 KQR^2 - KQR^2}{KQR^2} \times 100$
 $= \frac{0.96 - 1}{1} \times 100$
 $= -4\%$
P decreases by -4%

B1

M1

A1

SECTION 4

17a) $180^\circ - (90^\circ + 72^\circ) = 18^\circ = \angle YXW$

$\angle XYW = 90^\circ$ (Subtended by diameter)

Sum of angles in a triangle XYW

B1

B1

b) $\angle YZX = 72^\circ = \angle XZ$ (angles subtended by chord)

$180^\circ - (72^\circ + 72^\circ) = 36^\circ = \angle XYZ$

B1

B1

c) $\angle OYZ = 18^\circ$ (base angles of isosceles triangle)

B1

B1

d) $\angle WTZ = 180^\circ - (36^\circ + 18^\circ) = 126^\circ$

Angle sum of a triangle

B1

B1

e) $\angle WZV = 54^\circ$

Angles in alternate segments.

B1

B1

18 a) $a = 2, n = 8, S_n = 156.$

$S_n = \frac{n}{2} (2a + (n-1)d)$

i) $156 = \frac{8}{2} (2 \times 2 + (8-1)d)$

$156 = 4(4 + 7d)$

$156 = 16 + 28d$

$156 - 16 = 28d$

$140 = 28d$

$5 = d$

M1

A1

ii) $416 = \frac{n}{2} (2 \times 2 + (n-1) \times 5)$

$416 = \frac{n}{2} (4 + 5n - 5)$

$416 \times 2 = n(5n - 1)$

$832 = 5n^2 - n$

$0 = 5n^2 - n - 832$

M1

$$n = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(5)832}}{2 \times 5}$$

$$= \frac{1 \pm \sqrt{16641}}{10}$$

$$= \frac{1 \pm 129}{10} \quad \text{So } n = 13 \text{ or } -12.8$$

$$\text{So } n = 13.$$

A1

b) i) $a+2d, a+4d, a+7d.$

$$\frac{a+4d}{a+2d} = \frac{a+7d}{a+4d}$$

$$(a+4d)(a+4d) = (a+2d)(a+7d)$$

$$a^2 + 8ad + 16d^2 = a^2 + 9ad + 14d^2$$

$$2d^2 = ad$$

$$2d = a$$

$$2 \times 3 = a$$

$$6 = a$$

m1

m1

m1

A1

ii) $n = 9, a = a+2d = 12.$

$$S_n = \frac{a(r^n - 1)}{r - 1} = \frac{12(1.5^9 - 1)}{1.5 - 1}$$

$$= \frac{449.3}{0.5}$$

$$= 898.6$$

m1

A1

19.

a)

θ	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$2 \sin \theta$	0.00	1.00	1.73	2.00	1.73	1.00	0.00	-1.00	-1.73	-2.00	-1.73	-1.00	0.00
$2 \sin(2\theta + 60^\circ)$	1.73	1.73	0.00	-1.73	-1.73	0.00	1.73	1.73	0.00	-1.73	-1.73	0.00	1.73

B₂

c) Period of $y = 2 \sin(2\theta + 60^\circ) = 180^\circ$

i) Amplitude = 2

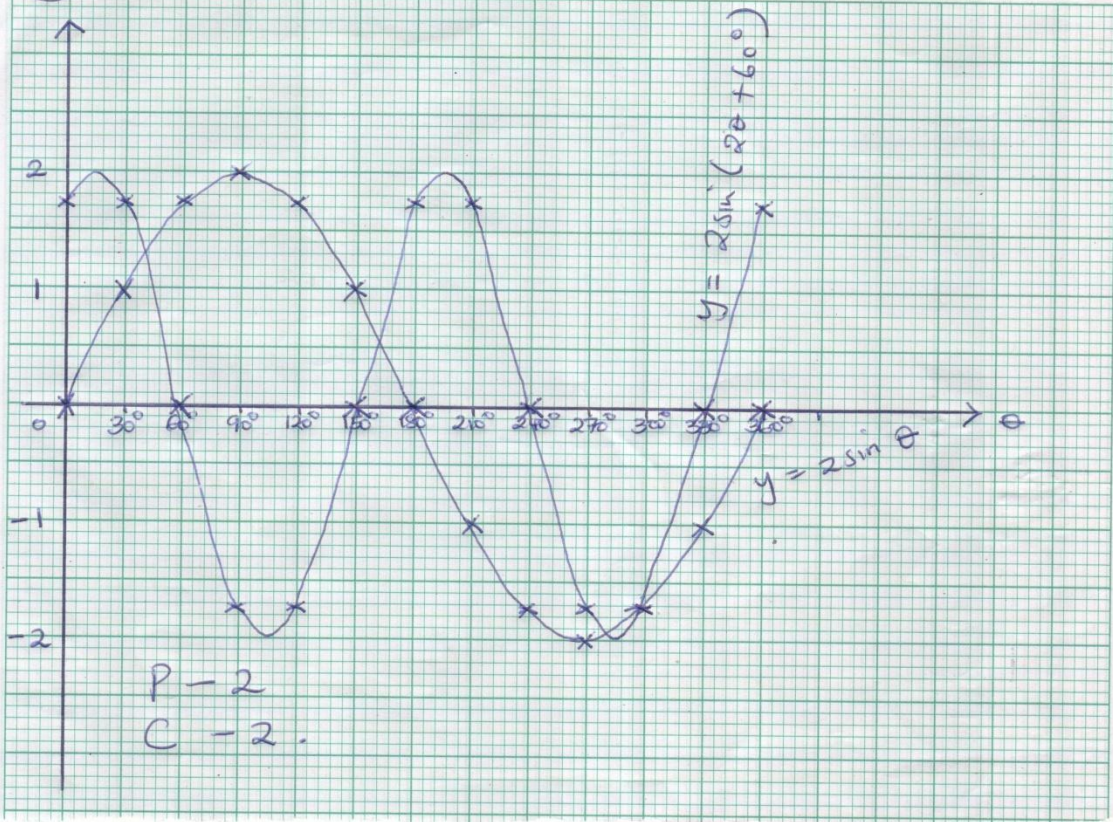
B1

B1

ii) $\theta = 40^\circ, 160^\circ, 280^\circ, 300^\circ$

B1 for all correct

b) (19)



d)	Translation vector = $\begin{pmatrix} -60^\circ \\ 0 \end{pmatrix}$	B1
20a) (i)	B(33°S, 129°W)	B1
(ii)	Dist = $\frac{180^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 6370$ = 20020 Km.	M1 A1
b)	45° - 32° = 13° Dist = $\frac{13^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 6370$ = 1445.87 = 1446 Km.	B1 M1 A1
c)	D = 5XT = 700X3 = 2100 Km. 2100 = $\frac{\theta}{360^\circ} \times 2 \times \frac{22}{7} \times 6370$ $\frac{2100 \times 360^\circ \times 7}{2 \times 22 \times 6370} = \theta$ 18.88° = θ 70° - 18.88° = 51.12° Q(51.12°N, 32°E)	B1 M1 M1 A1
21a) (i)	$\frac{1}{6} + \frac{1}{8} = \frac{7}{24}$ $\frac{1}{24} \times 3 = \frac{1}{8}$	M1 A1
ii)	$\frac{1}{8} - \frac{1}{4} = -\frac{1}{8}$ (out) In 1 hr empties $\frac{1}{8}$. ? " $\frac{1}{8}$. 7 hours to empty	M1 M1 A1

b)	$35m + 80B = 66$	M1
(i)	$\frac{m+B}{m+B}$ $66m + 66B = 35m + 80B$ $66m - 35m = 80B - 66B$ $\frac{31m}{B} = \frac{14B}{31}$ $\frac{m}{B} = \frac{14}{31}$ $m:B = 14:31$	M1 A1
(ii)	$= \frac{31}{45} \times 225$ $= 155 \text{ kg.}$	M1 A1.
22.		
a)	Taxable income = $26000 + \left(\frac{15}{100} \times 26000 - 800\right)$	M1
i)	$= \text{sh. } 29100$	A1
ii)	$\frac{10}{100} \times 9680 = 968$ $\frac{15}{100} \times 9120 = 1368$ $\frac{20}{100} \times 9120 = 1824$ $29100 - 27920 = 1180$ $\frac{25}{100} \times 1180 = 295$ $\text{Total tax} = 968 + 1368 + 1824 + 295$ $= \text{sh. } 3782$ $\text{Tax paid} = 3782 - 1162$ $= \text{sh. } 2620$	M1 M1 A1
iii)	Net salary = $29100 - (2620 + 800)$ $= \text{sh. } 25680$	B1

b) $16 \div 4 = 4\% = r$, $1\frac{1}{2} \times 4 = 6 = n$.

$P = 10,000$

$$A = P \left(1 + \frac{r}{100}\right)^n$$

$$= 10,000 \left(1 + \frac{4}{100}\right)^6$$

$$= 10,000 (1.04)^6$$

$$= 12,653.19$$

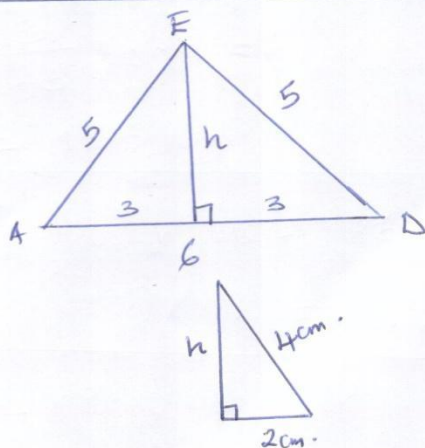
$$= \text{sh. } 12,653$$

M1

M1

A1

23.
a)



$$h^2 = 5^2 - 3^2$$

$$= 4 \text{ cm}^2$$

$$h^2 = 4^2 - 2^2$$

$$= 12$$

$$h = \sqrt{12}$$

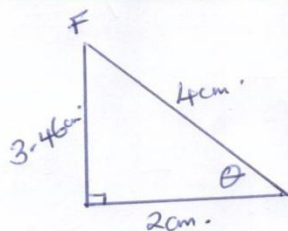
$$= 3.4641$$

$$= 3.46 \text{ cm}$$

M1

A1

b) i)



$$\sin \theta = \frac{O}{H} = \frac{3.46}{4} = 0.865$$

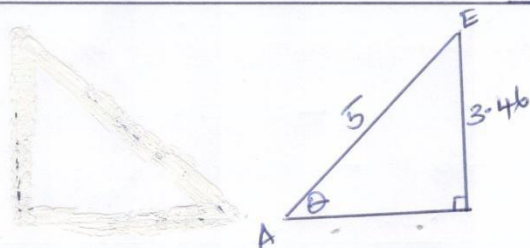
$$\sin^{-1} 0.865 = 59.88^\circ$$

$$= 60^\circ$$

B1

A1

ii)



$$\sin \theta = \frac{3.46}{5} = 0.692$$

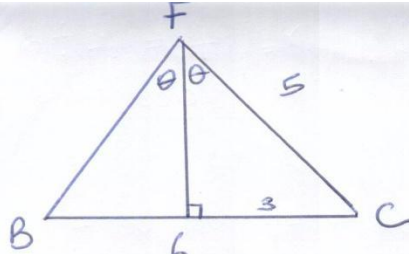
$$\sin^{-1} 0.692 = 43.788^\circ$$

$$= 43.8^\circ$$

M1

M1

A1

ii)	 $\sin \theta = \frac{O}{H} = \frac{3}{5} = 0.6$ $\sin^{-1} 0.6 = 38.87$ $= 77.74$ $= 77.7^\circ$	M/ M/ A/
24) a)	$\frac{dy}{dx} = 3ax^2 + b$ $\text{At } x=1, 3a(1)^2 + b = -5$ $3a + b = -5$ $y = ax^3 + bx$ $1 = a(1)^3 + b(1)$ $1 = a + b$ $3a + b = -5 \text{ --- (1)}$ $a + b = 1 \text{ --- (2)}$ $a = 1 - b$ $3(1 - b) + b = -5$ $3 - 3b + b = -5$ $-2b = -8$ $\frac{-2}{-2} \quad \frac{-8}{-2}$ $b = 4$ $a + 4 = 1$ $a = 1 - 4 = -3$	M/ both equations. A/ both values.
b) i)	$V = \frac{1}{2}(8)^2 - 3(8) + 7$ $= 15 \text{ m/s}$	B/
ii)	A minimum velocity, $a = 0$. $\frac{dv}{dt} = a = t - 3$ $t - 3 = 0$ $t = 3$ $V = \frac{1}{2}(3)^2 + 3(3) + 7 = 2.5 \text{ m/s}$	M/ A/
iii)	$S = \frac{1}{6}t^3 - \frac{3}{2}t^2 + 7t$ When $t = 2$ $S = \frac{1}{6}(2)^3 - \frac{3}{2}(2)^2 + 7(2)$ $= 9\frac{1}{3} \text{ m}$ When $t = 3$ $S = \frac{1}{6}(3)^3 - \frac{3}{2}(3)^2 + 7(3)$ $= 12 \text{ m}$ $D = 12 - 9\frac{1}{3} = 2\frac{2}{3} \text{ m}$	M/ M/ M/ A/