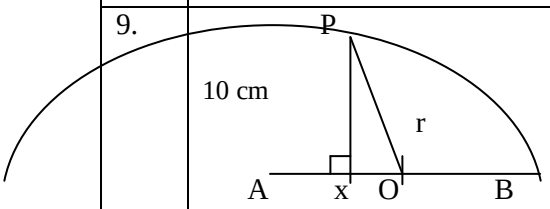
MATHS PAPER 1

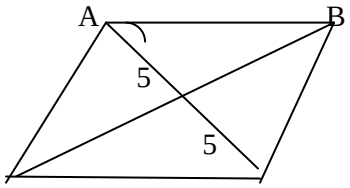
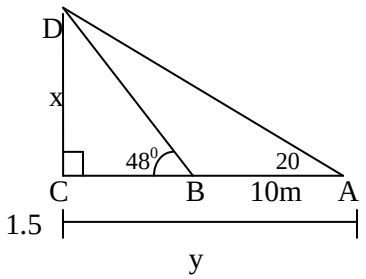
MARKING SCHEME

1.	$\frac{11}{5} + \frac{\cancel{2}^{1}}{\cancel{3}_{1}} X \frac{\cancel{15}^{5}}{\cancel{4}_{2}} - \frac{25}{6}$ $\frac{11}{5} + \frac{5}{2} - \frac{3}{4} = \frac{66 + 75 - 125}{30} = \frac{16}{30}$ $\frac{5}{4} - \frac{\cancel{12}^{3}}{\cancel{5}} x \frac{\cancel{3}}{\cancel{4}_{1}} + \frac{15}{4} =$ $\frac{5}{4} - \frac{9}{5} + \frac{15}{4} = \frac{16}{5}$ $\frac{\cancel{16}}{\cancel{30}_{6}} x \frac{\cancel{5}^{1}}{\cancel{16}} = {}^{1}/_{6}$	M1 M1 A1 3
2	$\frac{a^4 - b^4}{a^3 - ab^2}$ $\frac{\cancel{(a^2 - b^2)}(a^2 + b^2)}{a\cancel{(a^2 - b^2)}}$ $= \frac{a^2 + b^2}{a}$	M1 M1 A1 3
3.	$2y = -3x + 11$ $y = \frac{-3}{2}x = \frac{11}{2}$ $M1 = {}^{-3}/_{2}$ $\therefore M_2 = {}^{2}/_{3}$ $\frac{y+4}{x+3} = {}^{2}/_{3}$ $3y + 12 = 2x + 6$	

	$3y = 2x - 6$ $\therefore x\ intercept$ 3(0) = 2x – 6 2x = 6 X = 3 $\therefore A(3,0)$ T-intercept 3y = 0 – 6 y = -2 B (0, -2) $\|AB\| = \sqrt{(0-3)^2 + (-2-0)^2}$ $= \sqrt{9+4} = \sqrt{13}$	B1 B1 B1 3 marks
4.	$0.3309 + \left(\frac{1}{5.041\ x\ 10^{-3}}\right)$ 0.3309 + 3 (198.4) 0.3309 - 595.20 $= [595.5309]^{-2}$ $= \frac{1}{595.5309^2} = \frac{1}{[5.955309\ x\ 10^2]^2}$ $= \frac{1}{35.46\ x\ 10^4}$ $= \frac{1}{3.546\ x\ 10^5} = 0.2820\ x\ 10^{-5}$ $= 2.82\ x\ 10^{-6}$	M1 (correct square and cube root) M1 (correct reciprocal) M1 (correct square & reciprocal) A1 4 marks
5.	$2 - 5x \leq \frac{1}{3}(x+7)$ $2 - 5x \leq \frac{1}{3}x + \frac{7}{3}$ $\frac{2}{1} - \frac{7}{3} \leq \frac{1}{3}x + \frac{5}{1}x$ $\frac{6-7}{3} \leq x + \frac{15x}{3}$ $3x - \frac{1}{3} \leq \frac{16x}{3}\ x\ 3$	

	$\frac{-1}{16} \leq \frac{\cancel{16}x}{\cancel{16}}$ $\frac{1}{3}x + \frac{7}{3} \leq 6 - \frac{1}{3}$x $\frac{2}{3}x \leq \frac{6}{1} - \frac{7}{3}$ $\frac{2}{3}x \leq \frac{11}{3}$ $x \leq \frac{11}{2}$ $\frac{-1}{16} \leq x \leq \frac{11}{2}$ Sum = 0 + 5 = 5	B 1 M1 A1 3 marks
6.	20 km M ⟝——⟞ K 10.00 am 9.30 am Let Kilonzo's speed be x km/hr ∴ Makau's speed will – ¾ x In ½ hr Kilonzo covered ½ s km Remaining distance = (20 – 0.5x) km Time taken to meet 11:30 – 10:00 = 1 ½ hrs R.s = ¾ x + x = $^{7x}/_{4}$ $\frac{20 - 0.5x}{\frac{7x}{4}} = \frac{3}{2}$ 20 – 0.5x = $\frac{21x}{8}$ 160 – 4x = 21x 160 = 25x X = 6.4 km/hr Kilonzo's speed = 6.4 km/hr Makau's speed = ¾ x 6.4 = 4.8 km/hr	M1 A1 A1
7.	l.s.f. = $\frac{4}{12} = \frac{1}{3}$	M1

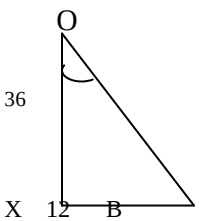
	$\therefore A.S.F. = \frac{1}{9}$ Let the area of ΔXYC be X. ∴ Area of triangle ACB = 9x 9x – x = 36 8x = 36 x = 4.5	 M1 A1 3 marks
8.	$\log \frac{b^2}{a} = \log b^2 - \log a$ 2(0.48) – 0.30 0.96 – 0.30 = 0.66	 M1 A1 2 marks
9.	 $10^2 + (r - 4)^2 = r^2$ $100 + r^2 - - 8r + 16 = r^2$ 116 = 8r r = 14.5	 M1 M1 A1 3 marks
10.	$\frac{dy}{dx} = 2x + 3$ $\int 2x + 3\, dy = x^2 + 3x + c$ $-1 = (-1)^2 + 3(-1) + c$ -1 = 1 – 3 + c -1 + 2 = c ∴ $y = x^2 + 3x + 1$	 M1 M1 A1 3 marks
11	$\left(\frac{\left(\frac{1}{3^3}\right)^{1/3} x\ 16\ x\ 3^6}{(3^6)^{-1/3}\ x\ (6\ x\ 6\ x\ 2)^2} \right)$ $\frac{\frac{1}{3}\ x\ 2^4\ x\ 3^2\ x\ 3^6}{2^6\ x\ 3^4}$	 M1

	$= \frac{2^4 \, x \, 3^7}{2^6 \, x \, 3^4}$ $= {}^{27}/_{4} = 6\,{}^{3}/_{4}$	M1 A1 3 marks
12.	Mid ordinates x | 0.5 | 1.5 | 2.5 y | 1.125 | 2.125 | 4.125 A = 1 [1.125 + 2.125 + 4.125] = 7.375 square units	B1 M1 A1 3 marks
13.	75^0  $\frac{5}{AB} = \cos 75$ AB = $\frac{5}{0.2588}$ = 19.32 AB = 19 cm Area = $\left[\frac{1}{2} x \; 19 \; x \; 19 \sin 150\right]$ x 2 = 180.5 cm^2	M1 A1 A1
14.	 Tan 20 = $\frac{x}{y}$ tan 40 = $\frac{x}{y-10}$ x = y tan 20 x = (y -10) tan 40 y tan 20 = 1 y tan 40 – 10 tan 40 y = $\frac{10 \tan 40}{\tan 40 - \tan 20}$ = $\frac{8.391}{0.4751}$ y = 17.66 x = 17.66 tan 20 = 6,428	M1 M1 A1

	height = 6.428 + 1.5 = 7.928 m	B1 4 marks
15	Actual $(4 - 5)^2 = 81$ Incorrect $(4)^2 + (-5)^2 = 41$ Error = $\frac{81-41}{81}\ x\ 100$ = 0.49%	B1 M1 A1 3 marks
16.	Length of tangents = $2\sqrt{18^2 - 15^2}$ = 19.9 cm $\frac{15}{18} = \cos\theta$ $\theta = 33.56^0$ $\frac{360 - 2\ (33.26)}{360}\ x\ 2\ x\ \frac{22}{7}\ x\ 9 = 46.024$ $\frac{67.12}{360}\ x\ 2\ x\ {}^{22}/_{7}\ x\ 6 = 7.032$ Total length = 19.9 + 46.024 + 7.032 = 72.96 cm	M1 M1 M1 A1 4 marks

17.	(a) R = r + 7 $\pi R^2 - \pi r^2 = \frac{21}{100}\pi r^2$ $\pi R^2 = 0.21\,\pi r^2 + \pi r^2$ $\pi R^2 = 1.21\pi r^2$ $R^2 = 1.21\,r^2$ R = 1.2r R + 7 = 1.1 r 7 = 1.1 r – r 7 = 0.1 r R = 70m	 M1 M1 M1 A1 4 marks
	(b) Inner radius = 70m $2\pi r = 2\,x\,\frac{22}{7}$ x 70 = 400m $\frac{440m}{10} = 44\,posts$ Outer radius r = 77m $2\pi r = 2\,x\,\frac{22}{7}\,x\,77 = 484m$ $\frac{484}{11} = 44\,posts$ Total number of posts = 88	 M1 A1 M1 A1 B1 5
	(c) total cost 88 x 105 = sh 9240	B 1

18.

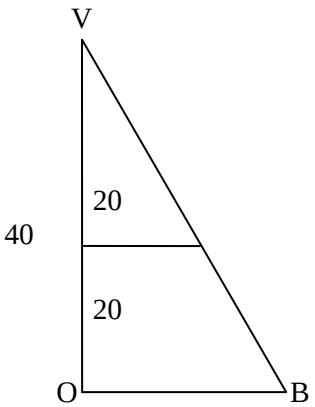


$\text{Sin } 36^0 = \frac{12}{H}$

$H = \frac{12}{\sin 36} = 20.4156194$ cm ✓(1)

But $\frac{h}{H} = \frac{12}{24}$, $\frac{h}{20th} = \frac{12}{24}$

24h = 240 + 12h
12h = 240
h = 20 ✓
H = 40 ✓ (1)



$VB = \sqrt{40^2 + \left(12/\sin 36\right)^2}$

$= \sqrt{2{,}016.797516}$

= 44.90876 ✓ (1)

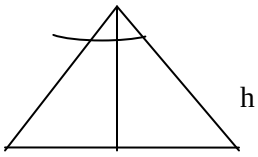
Hence $\frac{12}{24} = \frac{l}{44.90876}$ ✓ (1)

$l = \frac{1}{2}\ x\ 44.90876$

$\frac{12}{\sin 36}$

l = 22.454 cm ✓ (1)

5 marks

	(b)  Tan 36 = $\frac{12}{h}$ 77 h 12 24 h = $\frac{12}{\tan 36}$ A = $^1/_{\cancel{2}}$ x $\cancel{24}$ x $\frac{12}{\tan 36}$ = $\frac{144}{\tan 36} = 198.198$ ✓ (1) =990.995cm^2✓ (1) ∴ Area of pentagonal base = 5 x 198.198 Volume of the whole pentagonal cone $^1/_3$ x 990.995 x 40 = 118,919.3979 cm^3✓ (1) L.sf = 1: 2 V.sf = 1 : 8 8 → 118,919.3979 1 → ? $\frac{1\ x\ 118{,}919.3979}{8}$ = 14,864.92474 ✓ (1) Volume of trustum = 118,919.3979 – 14,864.92474 = 104,054.4743 cm^3✓ (1)	5 marks
19.	A + B + C + D (1 day) 4200 bags A + B = $\frac{\cancel{42000}}{\cancel{30}}$; 1400 (1 day) M1 C + D = $\frac{\cancel{42000}}{\cancel{30}}$; 2800 (1 day) A = $^3/_{2\,B}$ C = ^{1} $^4/_5$ D = $^9/5$D A1 (a) $^3/_2$b + B = 1400 B1 3B + 2B = 2800 5B = 2800 B = 560 bags A = $^3/_2$ x 560 = 840 bags B1 $^9/_5$ D + D = 2800 9D + 5D = 14000 14D = 14000 D = $\frac{1400}{14} = 1000\ bags$ B1 C = $^9/_5$ D = $^9/_5$ x 1000 = 1,800 bags B1	6 marks

	(b) A + B + C + D (840 + 560 + 1800 +1000) 5 (4200) = 21,000 5 days B1 A and B 5 (840 + 560) 5 x 1400 = 7000 B1 Remaining 42000 – 28000 = 14,000 bags B1 B takes $\frac{14000}{560} = 25\ days$ B1	4 marks
20.	(a) Eunice $\frac{45}{x}\ oranges$ Sharon $\left(\frac{45}{x-075}\right)$ oranges $\frac{45}{x} + \frac{45}{x-0.75}$ B1 $\frac{45\ (x-0.75)+\ 45x}{x\ (x-0.75)}$ B1 $\frac{90x-33.75}{x\ (x-0.75)}$ B1 (b) $\frac{45}{x-0.75} - \frac{45}{x} = 2$ M1 45x – 45x + 33.75 = 2x (x – 0.75) 33.75 = $2x^2$ – 1.5x $2x^2$ – 1.5x – 33.75 = 0 $8x^2$ – 6x – 135 = 0 M1 x = $\frac{6 \pm \sqrt{36+4320}}{16}$ x = $\frac{6 \pm 66}{16}$ x = -3.75 x = 4.5 A1 x = sh 4.50 Eunice sh 4.50 per orange B1 Sharon 4.50 – 75 = sh 3.75 B1 (c) Eunice $\frac{45}{3.75} = 12\ oranges$ } M1 Sharon = 14 oranges Total number = 12 + 14 = 26 oranges A1	10 marks

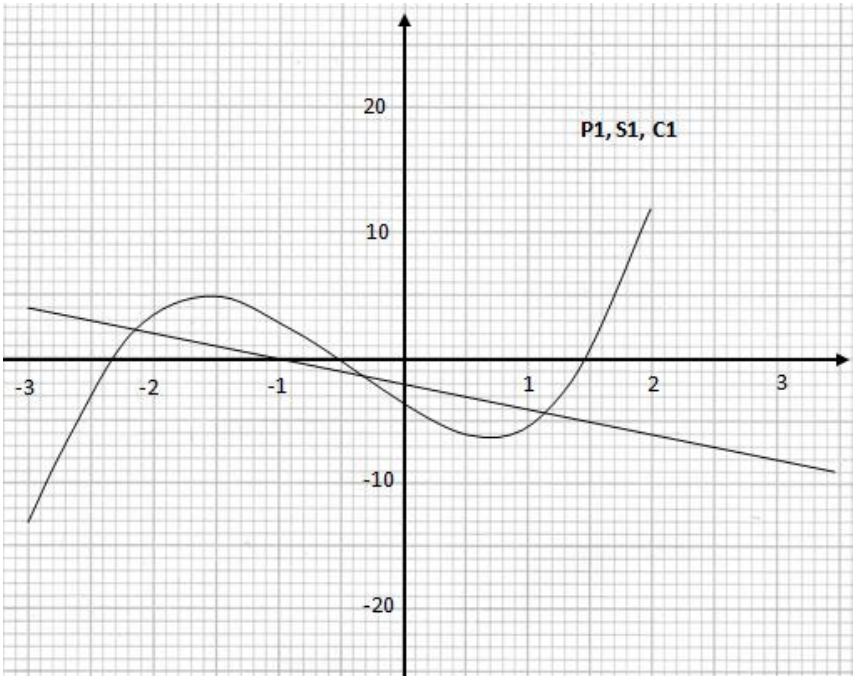
21	(i) ½ x 54 x V = 810 M1 V = $\frac{810\ x\ 2}{54}$ V = 30 m/sec A1 (ii) a = $\frac{V-u}{t}$ $^5/_3$t = 30 t = $\frac{30\ x\ 3}{5}$ = 18 secs Decc u = 30 m/s, V = om/s t = 54 – 18 = 36 secs a = $\frac{0-30}{36} = -^5/_{6\ m/s^2}$ $a = {}^5/_{6\ m/s^2}$ (b) (i) bus 60 km/h car 100 km/hr Time $^1/_0$ hr Distance = ½ x 60 = 30 km t = $\frac{D}{Rs} = \frac{30}{100-60} = \frac{30}{40} = \frac{3}{4}$hrs time 11.15 45 12.00 12.00 noon (ii) d = ¾ x 100 = 75 km Remaining 425 km Bus $\frac{425}{100}$ = 7 ½ hrs Car $\frac{425}{100}$ = 4 ¼ hrs 2 $^5/_6$ hrs Or 2 hours 50 minutes	M1 A1 M1 M1 A1 M1 M1 A1 10 marks

22 (a)	$V = at^2 + bt$ $2 = a + b$ $\int at^2 + bt = \frac{at^3}{3} + \frac{bt^2}{2} + c$ At t = 45 also at – t = 0 s – 0 s = 0 $0 = \frac{a\,(4.5)^3}{3} + \frac{b\,(4.5)^2}{2} + c$ $\frac{91.125}{3}a + \frac{20.25}{2}b = 0$ 182.25a + 60.75 b = 0 A = 2 – b 182.25 (2 – b) + 60.75b = 0 364.5 – 182.25 b + 60.75 b = 0 364.5 = 121.5b ∴ b = 3 A = 2-3 = -1	M1 M1 M1 A1 (for accurate values of a & b)
(b)	(i) $S = \frac{-t^3}{3} + \frac{3t^2}{2}$ $V = -t^2 + 3t$ $0 = -t^2 + 3t$ $t^2 = 3t$ t = 3 secs	M1 A1
	(ii) $\int_0^4 -t^2 + 3t\,dt = \left[\frac{-t^3}{3} + \frac{3t^2}{2} + c\right]_0^4$ $= \frac{-64}{3} + \frac{48}{2} + c - c$ $2\,{}^2/_3$	M1 A1

23

x	-4	-3	-2	-1	0	1	2	-1.5	0.5
y	-60	-28	4	3	-4	-5	12	5	-6

B1 B1B1



(i) $y = 2x^3 + 3x^2 - 6x - 4$
$-0 = 2x^3 + 3x^2 - 4x - 2$
$Y = -2x - 2$ B1

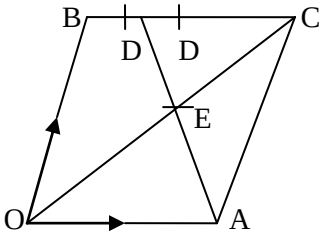
Solutions $x = -2.1, -0.5, 1.1$ B1

(ii) $\frac{4x^3}{4} + \frac{6x^2}{4} - \frac{12x}{4} - \frac{8}{4} = 0$

$x^3 + \frac{3x^2}{2} - 3x - 2 = 0$

$2x^2 + 3x^2 - 6x - 4 = y$ B1
$2x^3 + 3x - 6x - 4 = 0$

$x = -2.2, -0.6, 1.4$ B1

24.	**b**  **a** (a) (i) $\overrightarrow{Oc} = \mathbf{a} + \mathbf{b}$ (ii) $\overrightarrow{OE} =$ h (**a** + **b**) (iii) $\overrightarrow{AD}$ = **b** – ½ **a** (iv) $\overrightarrow{AE}$ = k (**b** – ½ **a**) (b) $\overrightarrow{OE}$ = **a** + k (**b** – ½ **a**) **a** + k**b** – ½ k**a** = h**a** + h**b** (1 – ½ k) = h K – h 1 – ½ h = h 1 = $^3/_2$h h = $^2/_3$ k = $^2/_3$ (c) $\overrightarrow{AE} = {}^2/_3\overrightarrow{AD}$ AE : ED 2 : 1 OE : OC OE = $^2/_3\overrightarrow{OC}$ = 2 :1	B1 B1 B1 B1 B1 M1 A1, A1 for h & k B1 B1