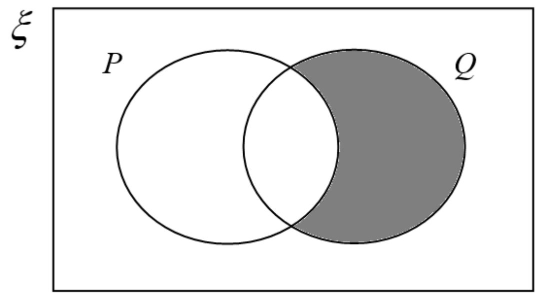
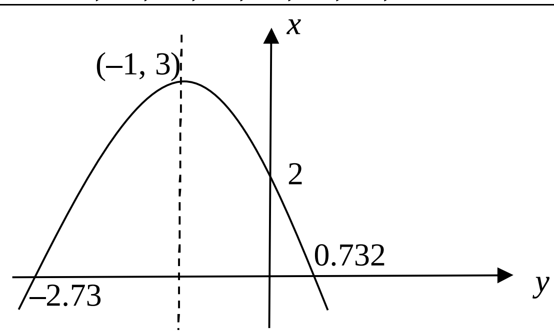
Mark Scheme for Paper 1

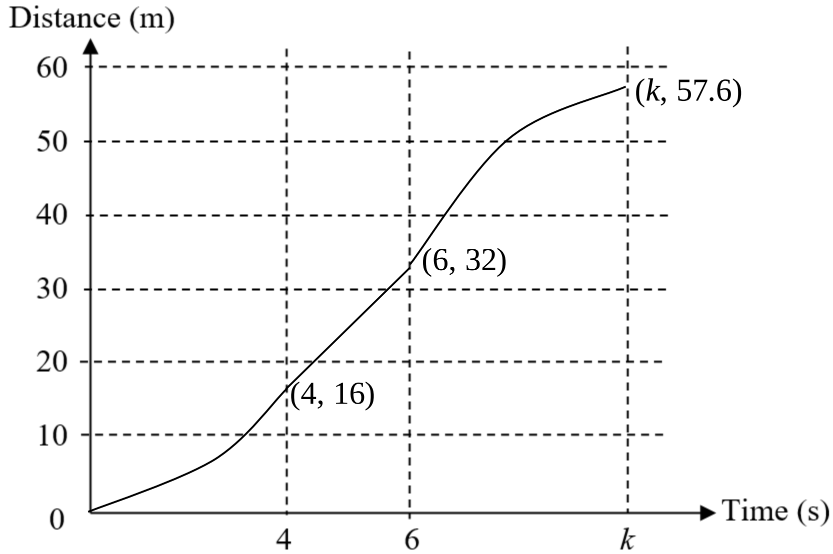
1	$2x+3y=4 \rightarrow 4x+6y=8$ $4x+y=-2$ Subtracting, $5y = 10$, so $y = 2$ Then $x = -1$	M1 accept substitution A1, A1
2	$3x(x-2)=1-8x$ $3x^2+2x-1=0$ $(3x-1)(x+1)=0$ Hence $x = 1/3$ or $x = -1$	M1 A1
3	$6u = 180°$ $u = 30°$ (exterior angle) So $n = \dfrac{360}{30}=12$	M1 A1
4(a)	Either 1. Yes does not indicate response is to choose petrol or milk. 2. No scale is provided for the bars to compared against the given percentages.	B1
4(b)	The values on the y-axis have been inverted, causing the graph to be inverted as well. Hence the graph now shows the opposite trend.	B1
5	$1000\left(1+\dfrac{r}{100}\right)^{10}=2000$ $\left(1+\dfrac{r}{100}\right)^{10}=2$ $1+\dfrac{r}{100}=2^{\frac{1}{10}}$ $r=100\left(2^{\frac{1}{10}}-1\right)=7.18\%$ (3 sf)	M1 A1
6(a)	$3ap+10by-5apy-6b= 3ap-5apy+10by-6b$ $= ap(3-5y)+2b(5y-3)$ $= ap(3-5y)-2b(3-5y)$ $= (ap-2b)(3-5y)$	M1 A1
6(b)	$\dfrac{x^2}{2}-\dfrac{9y^2}{2}= \dfrac{1}{2}\left(x^2-9y^2\right)$ $=\dfrac{1}{2}(x-3y)(x+3y)$	M1 A1

7	Map 1: 1 : 25000 = 1 cm : 0.25 km Area ratio = 1 cm^2 : 0.0625 km^2 30 cm^2 : 1.875 km^2 Map 2: 2 cm : 3 km = 1 cm : 1.5 km Area ratio = 1 cm^2 : 2.25 km^2 <u>5/6 cm^2</u> : 1.875 km^2 Accept 0.833 cm^2 (3 sf)	M1 M1 A1
8(a)	$y = \frac{k}{x^3}$, where k is any non-zero real number.	B1
8(b)(i)	Sub p = 27 and q = 9 into $p = k\sqrt{q}$, $27 = k\sqrt{9} \rightarrow k = \frac{27}{\sqrt{9}} = 9$ Hence $p = 9\sqrt{q}$ When x = 2, $y = \frac{125}{2^3} = 15\frac{5}{8}$ or 15.625	M1 A1
8(b)(ii)	Sub p = 81 into $p = 9\sqrt{q}$, $81 = 9\sqrt{q} \rightarrow \sqrt{q} = \frac{81}{9} = 9$ $q = 9^2 = 81$	B1
9	$2u + 15 + 5u + 15 + 3u + 15 = 115$ $10u + 45 = 115$ $10u = 70$ $u = 7$ Hence longest part = 5(7) + 15 = 50 m $\frac{50}{115} \times 100\% = 43\frac{11}{23}\%$ or 43.5% (3 sf)	M1 A1 M1, A1
10(a)	$x^2 - 21x + 3 = \left(x - \frac{21}{2}\right)^2 - \left(\frac{21}{2}\right)^2 + 3$ $= \left(x - 10\frac{1}{2}\right)^2 - 107\frac{1}{4}$ $= \left(-10\frac{1}{2} + x\right)^2 - 107\frac{1}{4}$	M1 A1
10(b)	$x^2 - 21x + 3 = 0 \rightarrow \left(-10\frac{1}{2} + x\right)^2 - 107\frac{1}{4} = 0$ $-10\frac{1}{2} + x = \pm\sqrt{107\frac{1}{4}}$ $x = 10\frac{1}{2} \pm \sqrt{107\frac{1}{4}}$ = 0.14 or 20.86 (2 dp)	M1 (/) A1 (both correct)

11(a)	There are 72 data, so the median terms are the 36th and 37th terms. Median is in the interval $20 < x \leq 30$.	B1
11(b)	Mean $= \dfrac{2010}{72} = 27.9$ years old SD = $\sqrt{\dfrac{69400}{72} - \left(\dfrac{2010}{72}\right)^2}$ = 13.6 years old (3 sf) No working is necessary.	B1 B1
12(a)		B1
12(b)	$X' \cap Y'$ or $(X \cup Y)'$	B1
12(c)	A = {2, 3, 5, 7, 11, 13, 17, 19, 23, 31, 37, 41, 43, 47} B = {1, 2, 5, 10, 25, 50} $A \cap B' = \{3, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47\}$ Hence $n(A \cap B') = 13$ and $n(B) < n(A)$	B1, B1
13.	X : (X + Y + Z) = $1^3 : 3^3 = 1 : 27$ X : (X + Y) = $1^3 : 2^3 = 1 : 8$ Hence Y = 7 units Then $k = \dfrac{7}{27}$	M1 (either ratio) A1
14(a)	$\left(\dfrac{6q}{p^3}\right)^3 \div \left(\dfrac{3}{p^2 q}\right)^{-1} = \left(\dfrac{6q}{p^3}\right)^3 \div \dfrac{p^2 q}{3} = \left(\dfrac{6q}{p^3}\right)^3 \times \dfrac{3}{p^2 q}$ $= \dfrac{648q^2}{p^{11}}$	M1 (either) A1
14(b)	$a \times a^2 \times a^3 \times a^n = \dfrac{1}{a^{10}} \rightarrow a^{6+n} = a^{-10}$ $6 + n = -10$ $n = -16$	B1 (working should be seen)
14(c)	$8^x = \sqrt[3]{64} \rightarrow (2^3)^x = (2^6)^{\frac{1}{3}}$ $2^{3x} = 2^2$ $3x = 2$ $x = \dfrac{2}{3}$	B1 (working should be seen)

15(a)	$c=\dfrac{35-(-13)}{4}=12$ $p=-13-12=-25$ $r=-13+12=-1$ $s=-1+12=11$ $t=11+12=23$	B2 (all correct) B1 – (two correct) B0 – (all wrong, or only one correct)
15(b)	$T_n=-25+(n-1)(12)=-37+12n$	B1
15(c)	8 terms They are 11, 23, 35, 47, 59, 71, 83, 95	B1
16(a)		G1 – correct shape and TP G1 – y –intercept correct
16(b)	Sub (0, 600): $600=a\left(b^0\right)=a$ Sub $\left(4,\ 189\frac{27}{32}\right)$: $189\dfrac{27}{32}=600\left(b^4\right)$ $b^4=\dfrac{81}{256}$ $b=\left(\dfrac{81}{256}\right)^{\frac{1}{4}}=\dfrac{3}{4}$	B1 B1
17(a)	$\dfrac{2}{10}=\dfrac{1}{5}$	B1
17(b)	Choose MALAYSIA COVID VIRUS + ITALY Consonants = 9, vowels = 6, P(vowel) = $\dfrac{6}{15}=\dfrac{2}{5}\neq\dfrac{4}{9}$ COVID VIRUS + MALAYSIA Consonants = 10 vowels = 8, P(vowel) = $\dfrac{8}{18}=\dfrac{4}{9}$ COVID VIRUS + SINGAPORE Consonants = 11, vowels = 8, P(vowel) = $\dfrac{8}{19}\neq\dfrac{4}{9}$	M1, A1

18	$\pi r^2 h = \frac{50}{100} \times \pi\left(50^2\right)h$ $r^2 = \frac{50}{100}\left(50^2\right) = 1250$ $r = \sqrt{1250} = 35.4$ cm (3 sf)	M1 A1
19	To find A, set $x = 0$: $y = 4$ Hence $A(0, 4)$ To find B, set $y = 0$: $0 = -\frac{4}{3}x + 4$ $x = 3$ Hence $B(3, 0)$ $AB = \sqrt{3^2 + 4^2} = 5$ Hence $\cos\theta = -\frac{3}{5}$	B1 B1 B1
20(a)	$OQ = OP$ (radii of circle) (S) Angle QOR=angle POS (vertically opposite angles are equal)(A) $OR = OS$ (radii of circle) (S) Hence by SAS, triangle OQR is congruent to triangle OPS. (also accept ASA with correct reasons)	M1 (any one) A1 (with correct conclusion)
20(b)	$\pi r^2 = 1018$ $r = \sqrt{\frac{1018}{\pi}} = 18.001$ m (5 sf) $\frac{180-100}{360} \times \pi\left(18.001\right)^2 = 226\frac{2}{9}$ m^2 or 226 m^2 (3 sf) Alternatively, 360° – 1018 80° – 226 m^2 (3 sf)	M1 A1
21(a)	$\sqrt{\left(k-3\right)^2 + \left(4-\left(-2\right)\right)^2} = 10$ $\left(k-3\right)^2 + 36 = 100$, $\left(k-3\right)^2 = 64$ $k - 3 = \pm\sqrt{64} = \pm 8$ $k = 11$ (reject) or -5	M1 A1
21(b)	Gradient PQ = $\frac{7-1}{6-(-4)} = \frac{3}{5}$ Gradient QR = $\frac{-1}{\left(\frac{3}{5}\right)} = -\frac{5}{3}$ Let $R(x, 0)$ and set gradient QR = $\frac{0-7}{x-6} = -\frac{5}{3}$ $-21 = -5\left(x-6\right) = -5x + 30$ $5x = 51$ $x = 10\frac{1}{5}$ Hence $R\left(10\frac{1}{5}, 0\right)$	M1 M1 A1

22(a)	$\dfrac{8}{1.25} = 6.4$ $k = 6 + 6.4 = 12.4$ s	B1
22(b)	Total dist = $\frac{1}{2}(4)(8) + 2\times 8 + \frac{1}{2}(6.4)(8)$ = 16 + 16 + 25.6 = 57.6 m Average speed = $\dfrac{57.6}{12.4} = 4\dfrac{20}{31}$ m/s or 4.65 m/s (3 sf)	M1 A1
22(c)		G1 – points are correct G1 – all shapes are correct
23(a)	Correct A – B1 Correct B – B1 Arcs at A and D must be seen, else minus 1 mark. Lines AB, AD and DC must be drawn, else minus 1 mark.	
23(b)	244° (accept 243° and 245°)	B1
23(c)	B1 – correct construction	
23(d)	B1 – correct construction	
23(e)	B1 – correct region shaded	