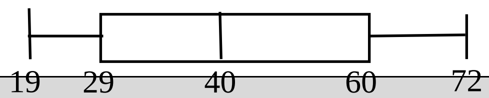
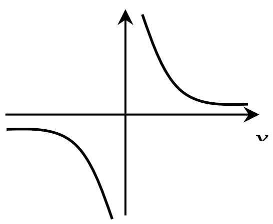
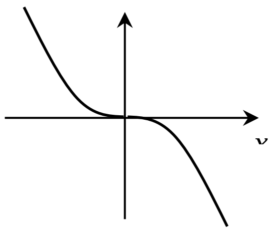
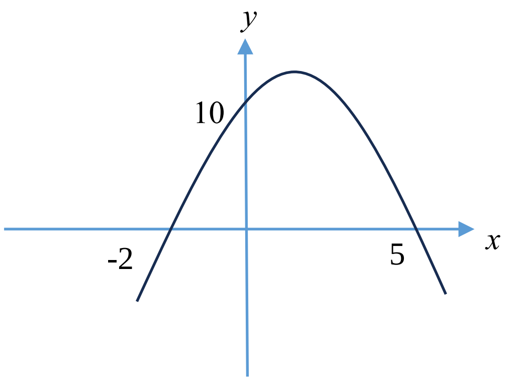
Paper 1

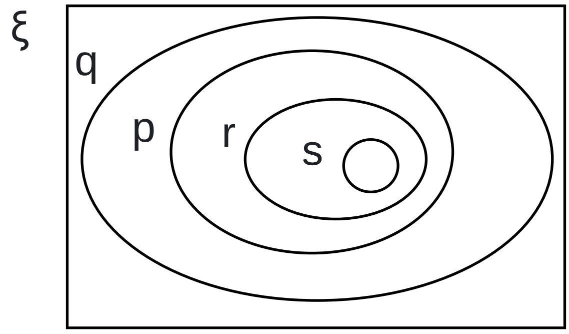
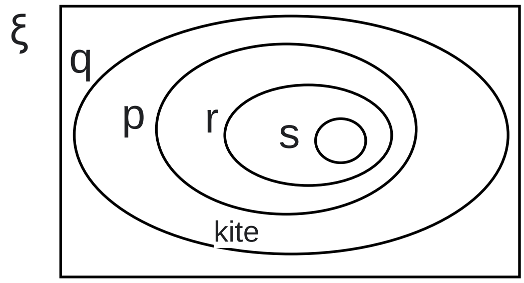
Qn No.	Solutions
1a	7.97×10^{22}
1b	Sum must be ≤ 349 $\frac{349}{3} = 116.333$ 3 even numbers are : 114, 116, 118
2a	$2y-1 < \frac{11y}{4}$ *and* $\frac{11y}{4} < \frac{1}{4}$ $8y-4 < 11y$ *and* $11y < 1$ $-3y < 4$ *and* $y < \frac{1}{11}$ $y > -1\frac{1}{3}$ *and* $y < \frac{1}{11}$ $-1\frac{1}{3} < y < \frac{1}{11}$
2b	$-25 + (-5)^2 = 0$
3a	$756 = 2^2 \times 3^3 \times 7$
3b	756 p = $2^2 \times 3^3 \times 7 \times p$ $495 = 3^2 \times 5 \times 11$ Smallest p = $5 \times 11 = 55$ Or LCM = $2^2 \times 3^3 \times 5 \times 7 \times 11$ $756p = 2^2 \times 3^3 \times 7 \times p$ $p = 5 \times 11 = 55$
3c	$756 \times \frac{a}{b}$ = perfect cube $2^2 \times 3^3 \times 7 \times \frac{a}{b}$ = perfect cube a = 2, b = 7
4a	$\frac{a^2-3a+2}{9a^2-1} \div \frac{2a-2}{6a-2}$ $= \frac{(a-2)(a-1)}{(3a-1)(3a+1)} \times \frac{2(3a-1)}{2(a-1)}$ $= \frac{a-2}{3a+1}$
5a	$\frac{(2x^3y^2)^{-4}}{(10x^{-2}y^3)^2} \div \sqrt[3]{27x^{-3}y^6}$

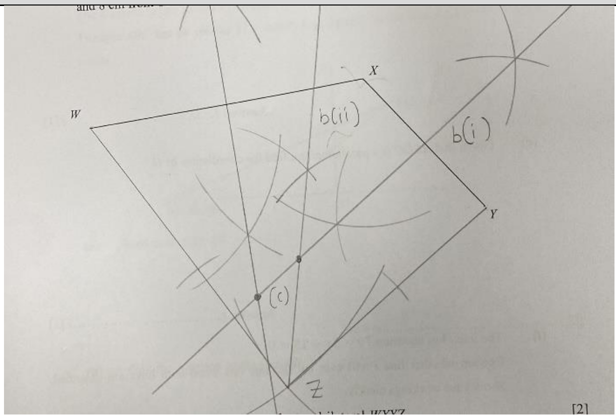
	$= \frac{2^{-4}x^{-12}y^{-8}}{100x^{-4}y^{6}} \times \frac{1}{(27x^{-3}y^{6})^{\frac{1}{3}}}$ $= \frac{1}{1600x^{8}y^{14}} \times \frac{1}{3x^{-1}y^{2}}$ $= \frac{1}{4800x^{7}y^{16}}$
5b	$3^{x+2} \times 3(3^5) = 1$ $3^{x+2} \times 3^1(3^5) = 1$ $3^{x+2} \times 3^6 = 3^0$ $x + 2 + 6 = 0$ $x = -8$
6a	$a^3 - 2a^2b - 4a + 8b$ $= a^2(a - 2b) - 4(a - 2b)$ $= (a^2 - 4)(a - 2b)$ $= (a - 2)(a + 2)(a - 2b)$
6b	$\frac{3x+2}{9x} = \frac{1}{7x-3}$ $(3x + 2)(7x - 3) = 9x$ $21x^2 - 9x + 14x - 6 = 9x$ $21x^2 - 4x - 6 = 0$ Using general formula $x = 0.638 \ or \ x = -0.448$
7	Bank A: Total amount = $P\left(1 + \frac{r}{100}\right)^n$ = 20000 $(1 + \frac{3}{100})^5$ = $23,185.48 Bank B: Total amount = 20000 + $\frac{3.2}{100} \times 20000 \times 5$ =$23,200 Bank C: Total amount = $23,000 He should invest in Bank B as the interest he get is the highest.
8a	Probability of all good apple $= \frac{17}{20} \times \frac{16}{19} \times \frac{15}{18}$

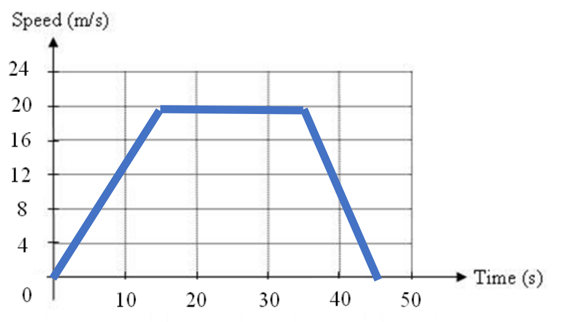
	= 0.59649 Probability of at least 1 bad = 1- 0.59649 = 0.404 or $\frac{23}{57}$
8b	No. $\frac{17}{20} \times \frac{16}{19} \times \frac{3}{18}$ refers to the probability of (Good, Good, Bad). It can also be (Good, Bad, Good) or (Bad, Good, Good). Probability should be $\frac{17}{20} \times \frac{16}{19} \times \frac{3}{18} + \frac{17}{20} \times \frac{3}{19} \times \frac{16}{18} + \frac{3}{20} \times \frac{17}{19} \times \frac{6}{18}$ $= 3\left(\frac{17}{20} \times \frac{16}{19} \times \frac{3}{18}\right)$
9	19 28 30 32 48 50 70 72 Median = $\frac{32+48}{2} = 40$ Lower quartile =$\frac{28+30}{2} = 29$ Upper quartile =$\frac{50+70}{2} = 60$ 
10a	
10b	
10c	$\frac{4}{x} + 2x^3 = 0$ $\frac{4}{x} = -2x^3$ no intersection for $y = \frac{4}{x}$ and $y = -2x^3$

	0 solution
11a	$-(x+2)(x-5)$ $= -(x^2-5x+2x-10)$ $= -(x^2-3x-10)$ $= -[(x-1.5)^2-(-1.5)^2-10]$ $= -[(x-1.5)^2-12.25]$ $= -(x-1.5)^2+12.25$ $p=-1.5.$ $\quad k=12.25$
11b	
11c	(1.5, 12.25)
12a	Angle ACD = 2 angle AOD $= 67^o \div 2$ $= 33.5^o$ (angle at centre = 2 angle at circumference) Angle BAO = 67^o (alt angles, AB // DO) Angle BCA = $180^o - 67^o - 90^o$ $= 23^o$ (right angle in semicircle) Angle BCD = $23^o + 33.5^o = 56.5^o$
12b	Angle DAB and angle DCB are angles in opposite segments in a circle and adds up to 180^o
12c	Angle DBA = angle DCA $= 33.5^o$ (angles in same segment) Angle DBC = $90^o - 33.5^o = 56.5^o$ (right angle in semicircle)
13	$\sqrt{3p^3+6r^2} = \frac{5r}{2}$ $3p^3+6r^2 = \frac{25r^2}{4}$ $12p^3+24r^2 = 25r^2$

	$12p^3 = r^2$ $r = \pm\sqrt{12p^3}$
14a	$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$ $\frac{9}{49} = \left(\frac{l_1}{l_2}\right)^2$ $\frac{l_1}{l_2} = \frac{3}{7}$ $\frac{V_1}{V_2} = \left(\frac{l_1}{l_2}\right)^3$ $\frac{V_1}{V_2} = \frac{27}{343}$ $V_1 = 1200 \div 343 \times 27 = 94.5\ cm^3$
14b	Radius 3 refers to that of water though qn may be a bit vague Volume of water = 94.5 × 80% = 75.6 $\frac{1}{3}\pi(3)^2 h = 75.6$ h = 8.02 cm Accept 3 as radius of cone also $\frac{V_1}{V_2} = \frac{4}{5}$ $\frac{r_1}{r_2} = \sqrt[3]{\frac{4}{5}}$ $r_1 = \sqrt[3]{\frac{4}{5}} \times 3 = 2.78495$ $\frac{1}{3}\pi(2.78495)^2 h = 75.6$ H = 9.31 cm
15a	$I = \frac{k}{d^2}$ $8 = \frac{k}{3^2}$ k = 72 $I = \frac{72}{d^2}$
15b	$I = \frac{72}{(0.25d)^2}$ $I = \frac{72}{0.0625d^2}$ $I = \frac{1152}{d^2}$ $\frac{1152}{72} = 16\ times$ % change = $\frac{1152-72}{72} \times 100\% = 1500\%$

16ai	Angle FGA= $\frac{(7-2)180}{7} = 128.57°$ Angle OGF = $128.57° \div 2 = 64.3°$
16aii	Angle GFH = $180 - 64.3 = 115.7°$ Angle EFH = $128.57 - 115.7 = 12.9°$
16b	Sum of exterior angle = 360º $$18 + 22 + 32 + 4(17) + (n-7)(20) = 360$$ $$140 + 20n - 140 = 360$$ $$n = 18$$
17a	 Square is a type of rectangle Square and rectangle is a type of parallelogram
17b	
18a	$AB = \sqrt{(6-0)^2 + (3-(-11))^2}$ = $\sqrt{36 + 196}$ =15.2 units
18b	Gradient = $\frac{6-0}{3-(-11)} = \frac{3}{7}$ y = mx +C At (3,6), $6 = \frac{3}{7}\ (3) + C$ C =$4\frac{5}{7}$ y = $\frac{3}{7}$x +$4\frac{5}{7}$
18c	y = mx +$4\frac{5}{7}$ at x = 0 y = $4\frac{5}{7}$

	$E = (0, 4\frac{5}{7})$
18d	$\frac{1}{2}(BC)(6) = 22.5$ BC = 7.5 C = $(-3.5, 0)$
18e	Coordinate A to C x shifted -6.5 units y shifted -6 units Coordinate D $= (-11 - 6.5\ ,\ \ 0 - 6)$ $= (-17.5\ ,\ -6)$
18f	$7y - 3x + 15 = 0$ $7y = 3x - 15$ $y = \frac{3}{7}x - \frac{15}{7}$ As line l has the same gradient $\frac{3}{7}$ as AB, the two lines are parallel and will not meet
19ai	
19aii	86°
19bi	See diagram above
19bii	See diagram above
19c	Draw perpendicular bisector of WX It is not possible to so, as the perpendicular bisector of WX, the perpendicular bisector of XY, and the angle bisector of WXY do not meet at a single point

20a	
20b	a = $\frac{change\ in\ speed}{change\ in\ time}$ = $\frac{20}{15}$ = 1.33 m/s^2
20c	Total distance = (0.5)(20)(15) + (20)(20) + (0.5)(10)(20) = 650 m Average speed = $\frac{650}{45}$=14.4 m/s