Western Mathematics Exams

School Name

Yearly Examination

2015

Year 10

Advanced Mathematics Course

Solutions

Year 10

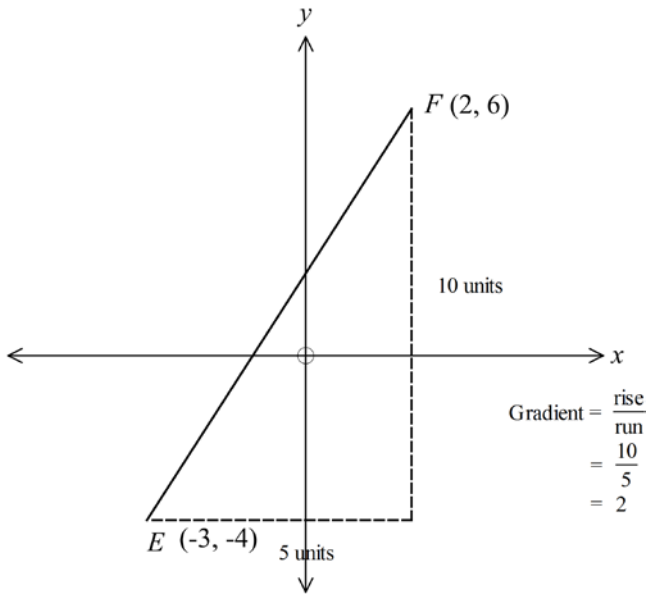
WME Yearly Advanced Maths

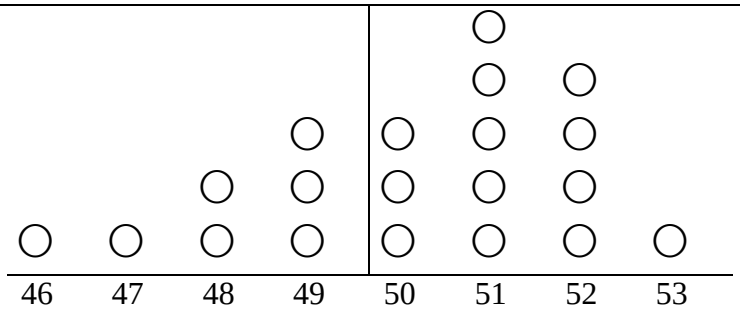
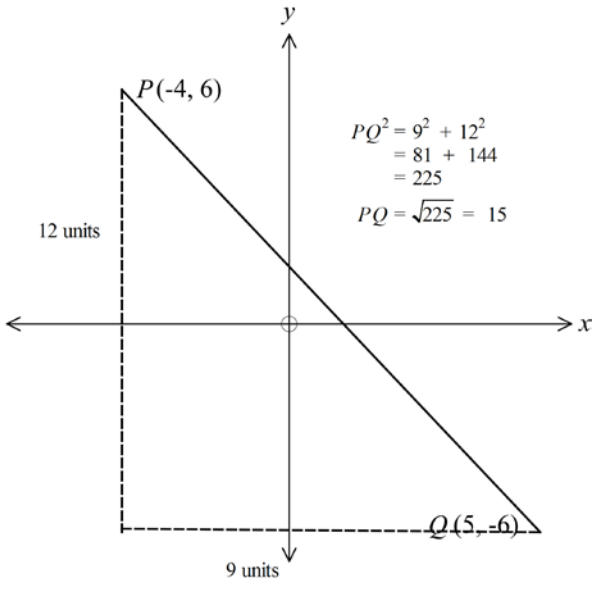
Non Calculator

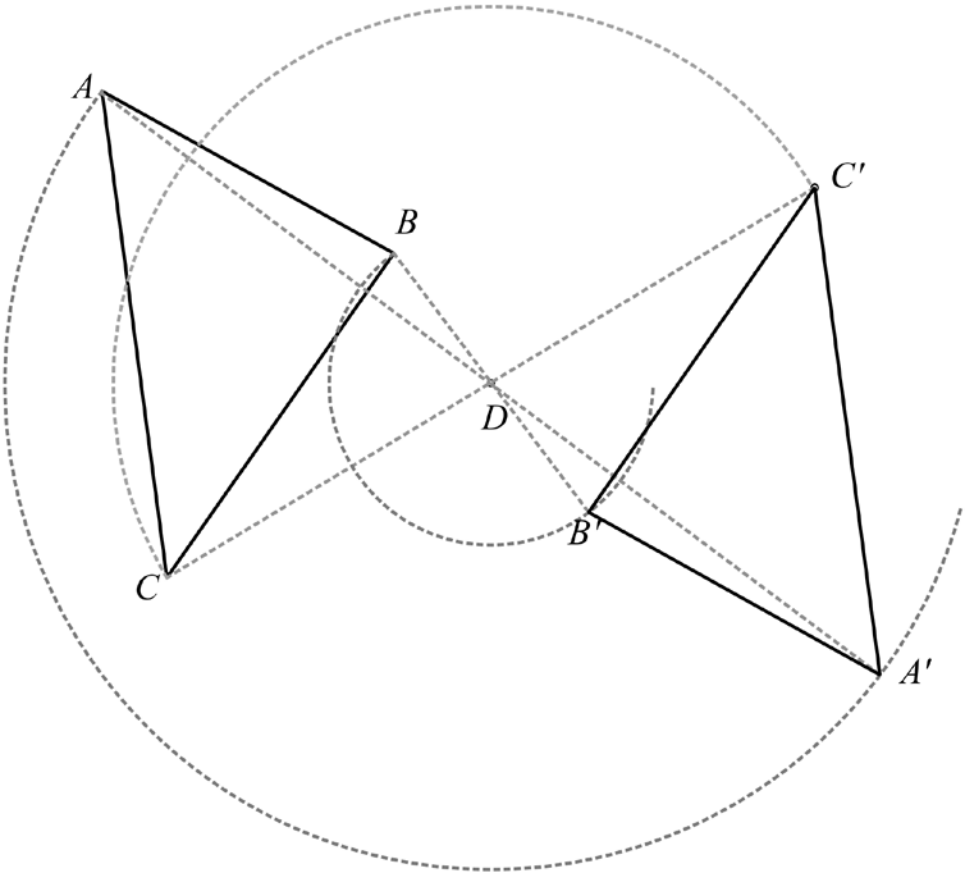
Section 1 Short Answer Section

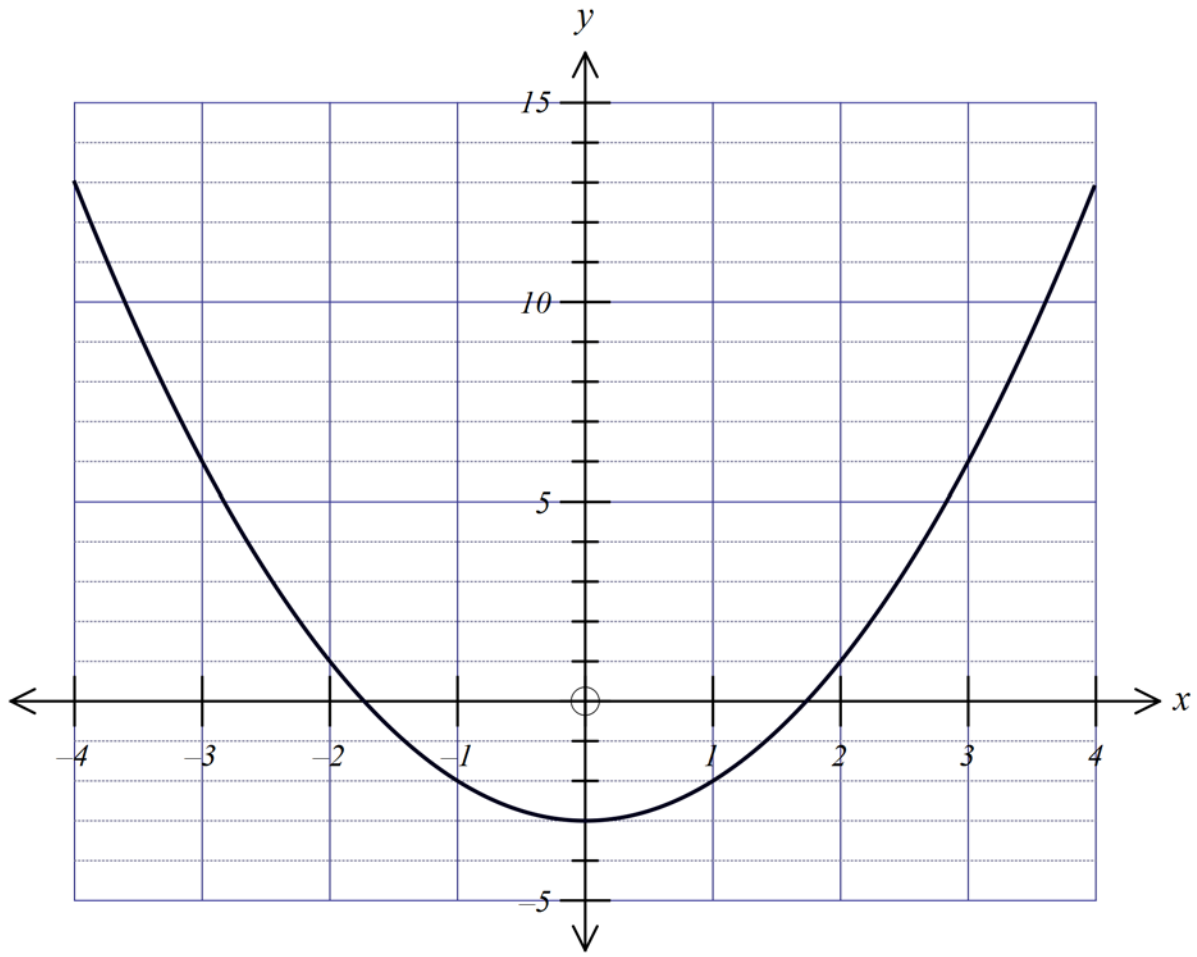
ANSWERS

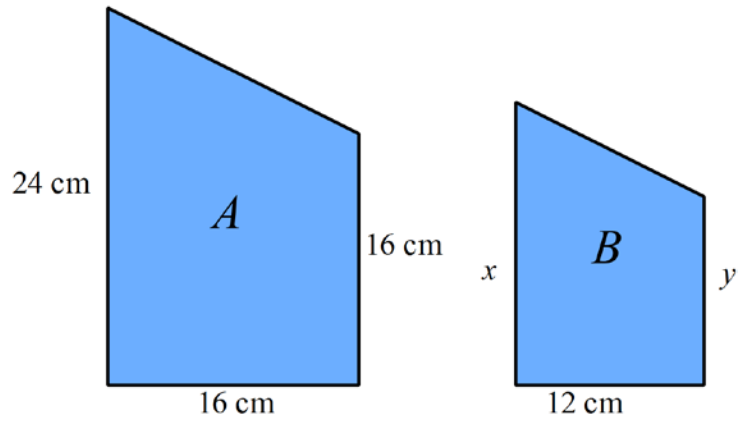
No.	WORKING	ANSWER
1.	$\frac{13}{20} = \frac{13 \times 5}{20 \times 5} = \frac{65}{100} = 0.65$ *OR* $13\overline{)20.00}$ 0.65	0.65
2.	$32\%\text{ of }\$125 = \frac{32}{100} \times 125 = \frac{8}{25} \times 125 = 8 \times 5 = 40$ *OR* $0.32 \times 125 = 40.00$	\$40
3.	$\text{Pay} = \$24 \times 40 = \$960$	\$960
4.	$x° + 55° + 90° + 95° = 360°$ $x + 240 = 360$ $x = 360 - 240$ $x = 120$	$x = 120$
5.	$\angle BAC + 75° + 38° = 180°$ $\angle BAC + 113 = 180$ $\angle BAC = 180 - 113$ $\angle BAC = 67$	$\angle BAC = 67°$
6.	$\text{Mass of thumb drives} = 200 \times 24g$ $= 4800\,g$ $= 4.8\text{ kg}$ $\text{Mass of packed carton} = 4.8 + 1.8$ $= 6.6\text{ kg}$	6.6 kg
7.	$\text{Area} = \frac{1}{2} \times 250 \times 120$ $= 250 \times 60$ $= 15\,000\text{ cm}^2$	15 000 cm^2

8.	$\text{Area Trapezium} = \frac{1}{2}h(a+b)$ $= \frac{20}{2}(20+40)$ $= 10 \times 60$ $= 600 \text{ cm}^2$ $\text{Volume} = A\ h$ $= 600 \times 30$ $= 18\,000 \text{ cm}^3$	$18\,000 \text{ cm}^3$
9.	$-3m \times -4n + \frac{16m^2n}{4m} = 12mn + 4mn$ $= 16mn$	$16mn$
10.	$6m + 4(3m+2) - 11 = 6m + 12m + 8 - 11$ $= 18m - 3$	$18m - 3$
11.		Gradient = 2
12.	$\frac{10x^3y^2 \times 6xy^5}{15x^2y} = \frac{60x^4y^7}{15x^2y}$ $= 4x^2y^6$	$4x^2y^6$

13.	$2(2c-5) = 15-c$ $4c-10 = 15-c$ $5c-10 = 15$ $5c = 25$ $c = \frac{25}{5} = 5$	$c = 5$
14.	 There are 7 out of 20 who score below 50. Percentage $= \frac{7}{20} \times 100$ $= 7 \times 5$ $= 35\%$	35%
15.	Median for 20 scores is the average of scores 10 and 11 So average of 50 and 51. Median is 50.5	50.5
16.	$12.5 : 50 = 125 : 500$ $= 5 : 20$ $= 1 : 4$	1 : 4
17.	 	$PQ = \sqrt{225} = 15$ cm

18.	$\cos N = \frac{A}{H} = \frac{7}{25}$	$\frac{7}{25}$
19.	$SA = 10 \times 15 \times 2 + 10 \times 20 \times 2 + 15 \times 20 \times 2$ $= 300 + 400 + 600$ $= 1300 \text{ cm}^2$	1300 cm^2
20.	$V = \frac{1}{3}Ah$ $= \frac{1}{3} \times 30 \times 12$ $= 10 \times 12$ $= 120 \text{ cm}^3$	120 cm^3
21.	The points *A'* and *B'* need to be located by any reasonable construction method and the triangle drawn and labelled.  	
22.	There are 5 black counters, 5 patterned counters and 4 white counters, so both black and patterned have a $\frac{5}{14}$ chance of being picked up.	Black and Patterned

23.	Gradient $m = -\frac{6}{2} = -3$ Y intercept $y = 6$ Equation : $y = -3x + 6$	$y = -3x + 6$
24.		

25.	 Call the parallel sides of B x and y. $\frac{x}{24} = \frac{12}{16}$ $x = 12 \times \frac{24}{16}$ $= 3 \times 6$ $x = 18$ cm $y = 12$ since there are 2 equal sides in A, so must be in B. Area $= \frac{12}{2}(18 + 12)$ $= 6 \times 30$ $= 180$ cm^2 **Can also be done by ratio of areas.** Ratios of Length A : Length B = 4:3 So ratio Area A : Area B = 16:9 $\frac{\text{Area B}}{320} = \frac{9}{16}$ Area B $= \frac{9}{16} \times 320 = 180$ cm^2	180 cm^2

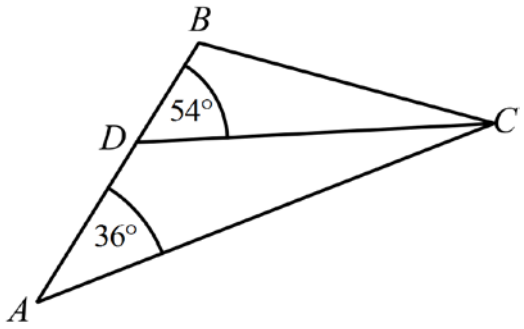
Year 10

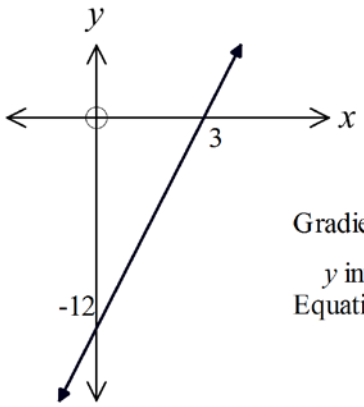
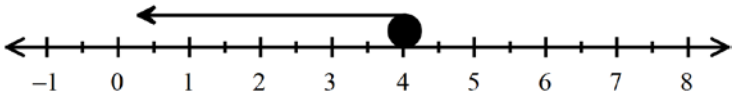
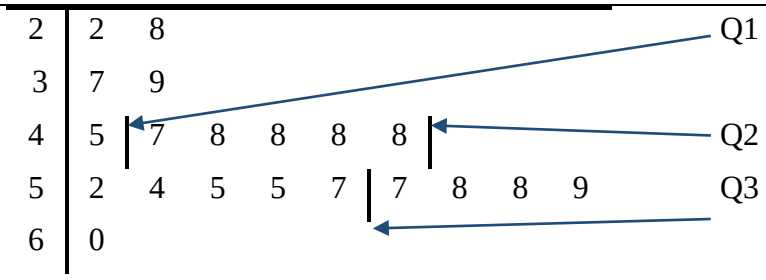
WME Yearly Advanced Maths

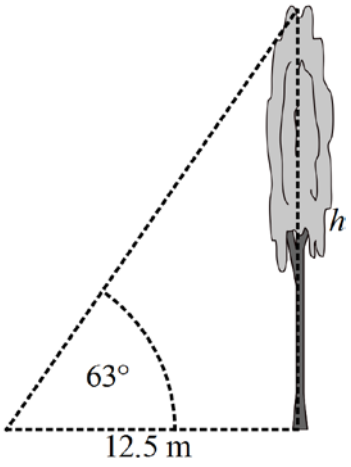
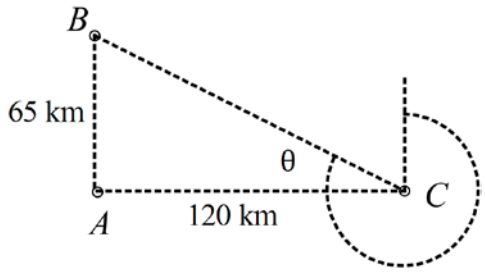
Calculator Allowed

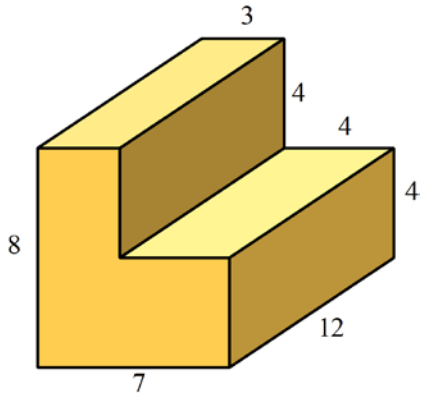
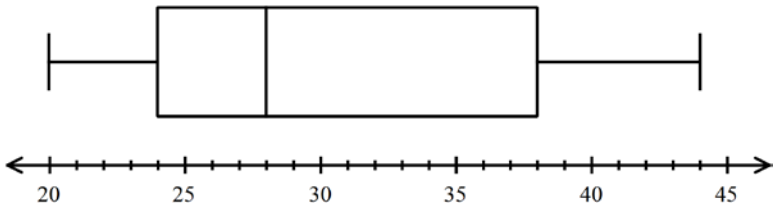
Section 2 **Part A** Multiple Choice Section

ANSWERS

No.	WORKING	ANSWER
26.	$73\%,\ 0.75 = 75\%,\ \frac{4}{5} = 80\%,\ 0.9 = 90\%$.	C
27.	35 normal hours plus 8 hours at time and a half Equivalent to $35 + 8 \times 1.5 = 35 + 12 = 47$ hours Pay = $\$48 \times 47 = \$2256$	B
28.	$x + 96 = 85 + 65$ (exterior angle) $x + 96 = 150$ $x = 150 - 96$ $x = 54$	B
29.	 $AB = BC$, so $\angle BCA = \angle BAC = 36°$ (isosceles Δ) $\angle ABC = \angle DBC = 180 - 2 \times 36 = 108°$ (angle sum $\Delta\ ABC$) $\angle BCD = 180 - (108 + 54) = 18°$ (angle sum $\Delta\ BCD$) $\angle DCA = 36 - 18 = 18°$	A
30.	A quarter past four in the afternoon is 16 :15 From 13 :35 to 14:00 is 25 minutes. From 14 :00 to 16:25 is 2 hours and 15 minutes. Overall 2 hours and 15 minutes. + 25 minutes = 2 hours and 40 minutes	D
31.	$\text{Area} = \frac{1}{2} \times 8 \times 15 + 18 \times 15 + \frac{1}{2} \times 12 \times 15$ $= 60 + 270 + 90$ $= 420\ \text{cm}^2$	C
32.	$x = -2$ and $y = -1$. $2x^2y - y^2 = 2 \times (-2)^2 \times (-1) - (-1)^2$ $= -8 - 1$ $= -9$	A

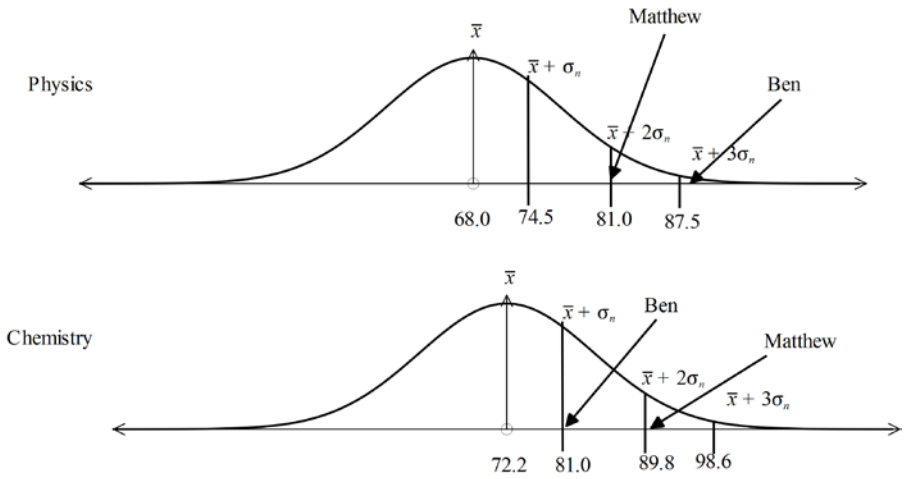
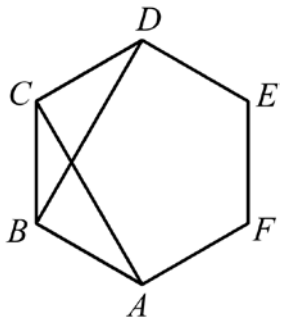
33.	$\frac{2x^2}{3} - \frac{2x^2}{6} = \frac{2x^2}{3} - \frac{x^2}{3} = \frac{x^2}{3}$	B
34.	 Gradient $= \frac{12}{3} = 4$ y intercept $= -12$ Equation $y = 4x - 12$	D
35.	$7.5 \times 10^9 = 7\,500\,000\,000$ km	C
36.	$2x - 3 \leq 5$ $2x \leq 8$ $x \leq 4$ 	C
37.	The data is numerical and since there are points, it is discrete.	C
38.	 Q2 (median) $= \frac{48 + 52}{2} = 50$ Q1 (1st quartile) $= \frac{45 + 47}{2} = 46$ Q3 (3rd quartile) $= \frac{57 + 57}{2} = 57$ Interquartile range $= 57 - 46 = 11$	B

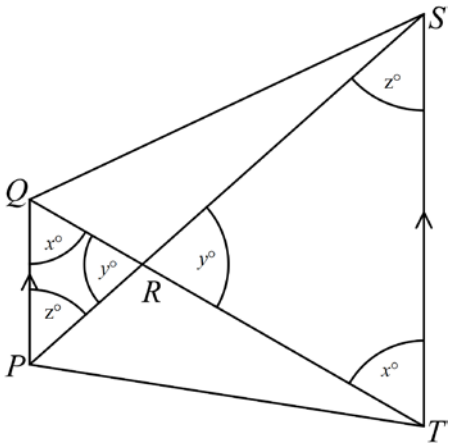
39.	P (56 or greater) = $\frac{6}{20} = \frac{3}{10}$ P (less than 56) = $1 - \frac{3}{10} = \frac{7}{10}$	D
40.	$\tan 63° = \frac{h}{12.5}$ $h = 12.5 \times \tan 63°$ $= 24.5$ m 	D
41.	First find $\angle\theta$ in Δ $\tan\theta = \frac{65}{120}$ $\theta = \tan^{-1}\left(\frac{65}{120}\right)$ $\theta = 28°$ Bearing = 270 + 28 = 298° 	D
42.	$SV = IV(1-R)^N$ $= 3500(0.76)^4$ $= 1167.67616$ $= \$1167.68$	A
43.	$900\ m = 0.9$ km $S = \frac{d}{t}$ $120 = \frac{0.9}{t}$ $t = \frac{0.9}{120}$ $= 0.0075$ hours $= 0.0075 \times 60 \times 60$ seconds $= 27$ seconds	A

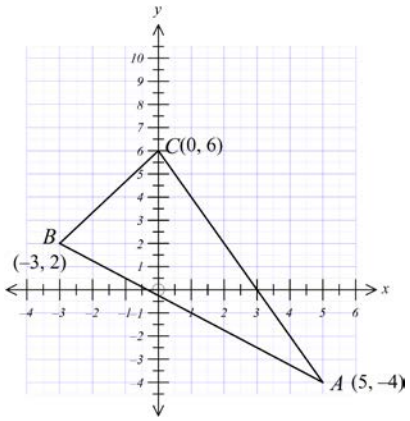
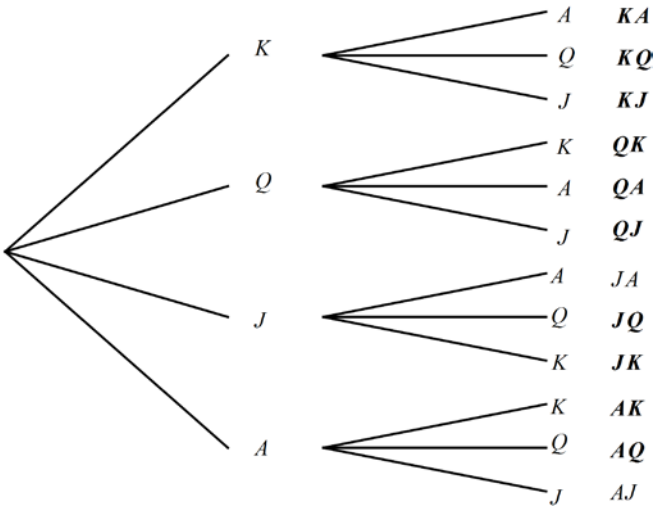
44.	$V = \frac{4}{3}\pi r^3$ $= \frac{4}{3} \times \pi \times 1.2^3$ $= 7.2 \text{ m}^3$	A
45.	$SA = 2 \times (8 \times 7 - 4 \times 4) + (7 \times 12 \times 2) + (8 \times 12 \times 2)$ $= 80 + 168 + 192$ $= 440 \text{ cm}^2$ 	B
46.	 24 is the bottom of the box, so the lower quartile (25% mark). 44 is the top extreme (100% mark) There are 75% of scores between these.	D
47.	$y = 2x + 4$ and $y = 2x + 7$ Both have a gradient of 2, so are parallel.	C
48.	It is a concave down parabola, so the equation could be $y = 6 - x^2$	C

49.	The triangles are similar, one pair of equal angles given, and a pair of vertically opposite angles equal, so triangles are equiangular and hence similar. $\frac{TR}{12} = \frac{25}{10}$ $TR = 12 \times \frac{25}{10}$ $= 30$ cm	B
50.	A strong positive relationship indicates the points group around a straight line which has a positive gradient, so A meets this criteria.	A
51.	$2x + 3y - 12 = 0$ $3y = -2x + 12$ $y = -\frac{2}{3}x + 4$ Gradient is $-\frac{2}{3}$ Perpendicular line has gradient $\frac{3}{2}$. Required line $y = \frac{3}{2}x - 4$	D
52.	$(a^2)^{-\frac{3}{4}} = a^{-\frac{3}{2}} = \frac{1}{a^{\frac{3}{2}}} = \frac{1}{\sqrt{a^3}}$	B
53.	$\frac{4x-5}{3} - 3x = 15$ $4x - 5 - 9x = 45$ $-5x = 50$ $x = -10$	A
54.	From calculator, correct to 1 dp. Mean = 8.3 SD = 0.9	A
55.	$(2x + 3)(x - 5) = 2x^2 - 10x + 3x - 15 = 2x^2 - 7x - 15$	C
56.	$y = (x-4)^2$ represents a parabola, so C or D. Find x intercept $y = 0$, $(x-4)^2 = 0$ $x - 4 = 0$ $x = 4$ So graph D	D

57.	$3a^2 + 8a - 3 = 0$ $3a^2 + 9a - a - 3 = 0$ $3a(a+3) - (a+3) = 0$ $(3a-1)(a+3) = 0$ $3a - 1 = 0$ or $a + 3 = 0$ $3a = 1$ or $a = -3$ $a = \frac{1}{3}$ or $a = -3$	B
58.	$x + 3y - 5 = 0$..... ① $y = 2x + 4$ ..... ② $x + 3(2x+4) - 5 = 0$ sub ② into ① $x + 6x + 12 - 5 = 0$ $7x + 7 = 0$ $7x = -7$ $x = -1$ $y = 2(-1) + 4$ $= -2 + 4$ $= 2$ Point is $(-1, 2)$	B
59.	Begins increasing at a decreasing rate due to gradual widening. Then increases at a constant rate due to constant width. Then increases at a faster constant rate due to sudden narrowing. Lastly increases at an increasing rate due to gradual narrowing.	A
60.	$\sqrt{50} + \sqrt{18} - \sqrt{72} = \sqrt{25} \times \sqrt{2} + \sqrt{9} \times \sqrt{2} - \sqrt{36} \times \sqrt{2}$ $= 5\sqrt{2} + 3\sqrt{2} - 6\sqrt{2}$ $= 2\sqrt{2}$	C
61.	$SA = \pi r^2 + \pi rl$ $= \pi \times 12^2 + \pi \times 12 \times 20$ $= 144\pi + 240\pi$ $= 384\pi$	C
62.	$2 - 4x \leq x + 12$ $-4x \leq x + 10$ $-5x \leq 10$ $x \geq -2$	D
63.	$(3x - 5y)^2 = (3x)^2 - 2(3x)(5y) + (5y)^2 = 9x^2 - 30xy + 25y^2$	A

64.	$P = 12500$ $r = 0.72 \div 12 = 0.006$ $n = 1.5 \times 12 = 18$ $A = P(1+r)^n$ $= 12500(1.006)^{18}$ $= 13921.103615$ $= \$13\,921.10$	C
65.	 Ben's Physics mark is over 3 SD above the mean, where the best of the others is just over 2 SD above the mean, so it is the best in comparison.	B
66.	$EG^2 = 10.2^2 + 12.5^2 - 2 \times 10.2 \times 12.5 \times \cos 74°$ $= 190.002...$ $EG = \sqrt{190.002..}$ $= 13.78414.....$ $= 13.8$ km	B
67.	In ΔABC and ΔDCB $BA = CD$ (sides of regular hexagon) $\angle ABC = \angle DCB$ (angles in regular hexagon) CB is common $\Delta ABC \equiv \Delta DCB\ (SAS)$ 	C
68.	There are 8 colours on each, so there are $8 \times 8 = 64$ pairs of colours possible.	C

69.	Line with gradient of $\frac{1}{2}$ through the point (12, 5). $y = \frac{1}{2}x + b$ $5 = \frac{1}{2} \times 12 + b$ $5 = 6 + b$ $b = -1$ $y = \frac{1}{2}x - 1$	A
70.	The angles marked x, y and z are equal. $\therefore \Delta PQR \,|||\, \Delta STR$. Not enough information about the other triangles to prove congruence or similarity. 	A
71.	$\frac{\sin A}{14.5} = \frac{\sin 64°}{20.2}$ $\sin A = \frac{14.5 \times \sin 64°}{20.2}$ $= 0.645174$ $A = \sin^{-1}(0.645174)$ $= 40°$	D

72.	$AB^2 = 8^2 + 6^2$ $= 100$ $AB = 10$ $BC^2 = 3^2 + 4^2$ $= 25$ $BC = 5$ $AC^2 = 5^2 + 10^2$ $= 125$ $AC = \sqrt{125}$ $AC \neq BC \neq AB$ so not isosceles or equilateral $AB^2 + BC^2 = 125 = AC^2$ $\therefore$ **it is right angled**, so not obtuse. Could also be found using gradients.  	D
73.	 $P(K \text{ or } Q \text{ or both}) = \frac{10}{12} = \frac{5}{6}$	C
74.	$2x^2 - 9x + 5 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{9 \pm \sqrt{81 - 4(2)(5)}}{2 \times 2}$ $= \frac{9 \pm \sqrt{81 - 40}}{4}$ $= \frac{9 \pm \sqrt{41}}{4}$	B

75.	The graph is an exponential so the equation could be $y = 2^x$.	D

School Name

Year 10 Yearly Examination

WME Yearly Advanced Maths Course 2015

Multiple Choice Section Answer Sheet

Name _____ Teacher _____

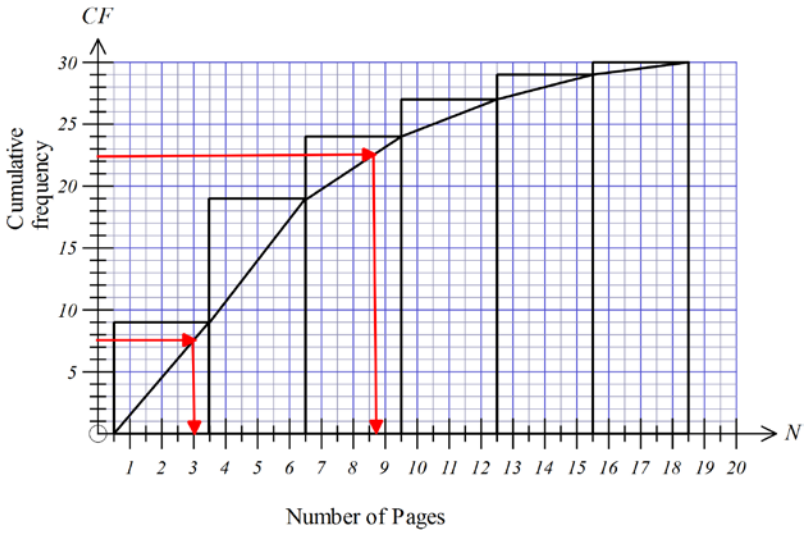
Completely fill the response oval representing the most correct answer.
Use a black or blue pen or 2B pencil.

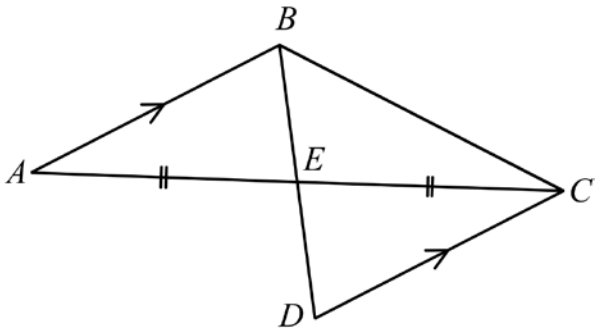
26.	A ○	B ○	C ●	D ○		51.	A ○	B ○	C ○	D ●
27.	A ○	B ●	C ○	D ○		52.	A ○	B ●	C ○	D ○
28.	A ○	B ●	C ○	D ○		53.	A ●	B ○	C ○	D ○
29.	A ●	B ○	C ○	D ○		54.	A ●	B ○	C ○	D ○
30.	A ○	B ○	C ○	D ●		55.	A ○	B ○	C ●	D ○
31.	A ○	B ○	C ●	D ○		56.	A ○	B ○	C ○	D ●
32.	A ●	B ○	C ○	D ○		57.	A ○	B ●	C ○	D ○
33.	A ○	B ●	C ○	D ○		58.	A ○	B ●	C ○	D ○
34.	A ○	B ○	C ○	D ●		59.	A ●	B ○	C ○	D ○
35.	A ○	B ○	C ●	D ○		60.	A ○	B ○	C ●	D ○
36.	A ○	B ○	C ●	D ○		61.	A ○	B ○	C ●	D ○
37.	A ○	B ○	C ●	D ○		62.	A ○	B ○	C ○	D ●
38.	A ○	B ●	C ○	D ○		63.	A ●	B ○	C ○	D ○
39.	A ○	B ○	C ○	D ●		64.	A ○	B ○	C ●	D ○
40.	A ○	B ○	C ○	D ●		65.	A ○	B ●	C ○	D ○
41.	A ○	B ○	C ○	D ●		66.	A ○	B ●	C ○	D ○
42.	A ●	B ○	C ○	D ○		67.	A ○	B ○	C ●	D ○
43.	A ●	B ○	C ○	D ○		68.	A ○	B ○	C ●	D ○
44.	A ●	B ○	C ○	D ○		69.	A ●	B ○	C ○	D ○
45.	A ○	B ●	C ○	D ○		70.	A ●	B ○	C ○	D ○
46.	A ○	B ○	C ○	D ●		71.	A ○	B ○	C ○	D ●
47.	A ○	B ○	C ●	D ○		72.	A ○	B ○	C ○	D ●
48.	A ○	B ○	C ●	D ○		73.	A ○	B ○	C ●	D ○
49.	A ○	B ●	C ○	D ○		74.	A ○	B ●	C ○	D ○
50.	A ●	B ○	C ○	D ○		75.	A ○	B ○	C ○	D ●

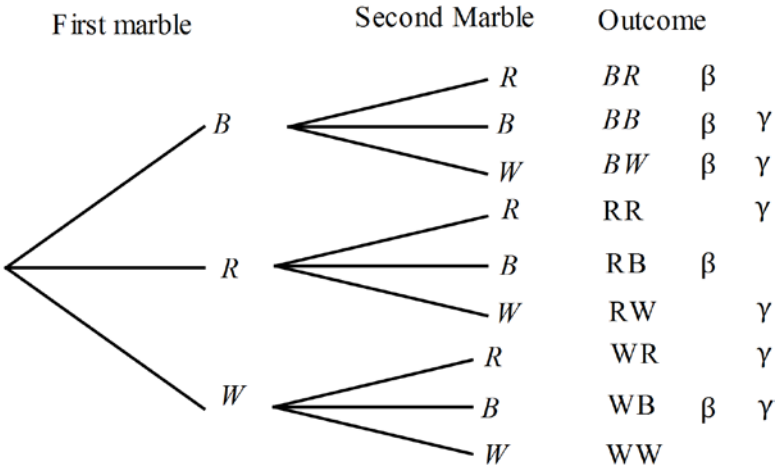
Year 10	*WME Yearly Advanced Maths*	Calculator Allowed

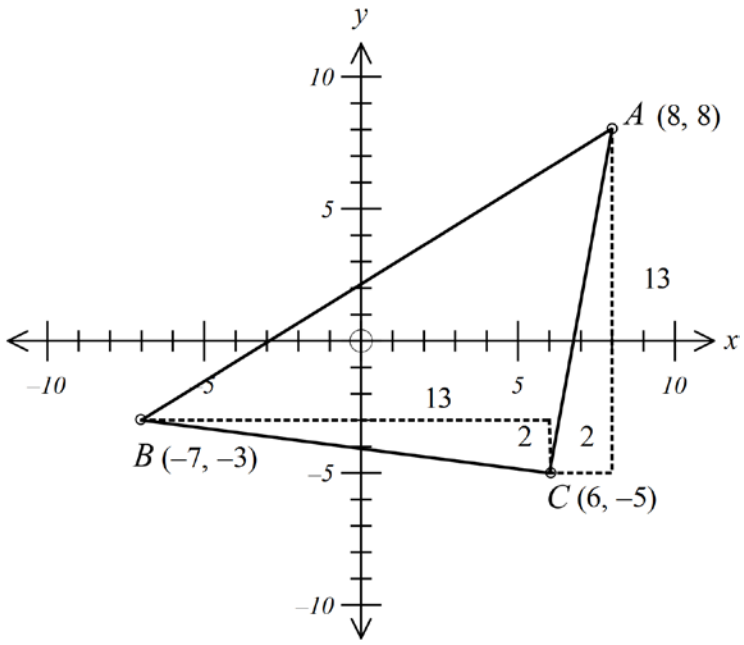
Section 2 Part B Longer Answer Section

ANSWERS

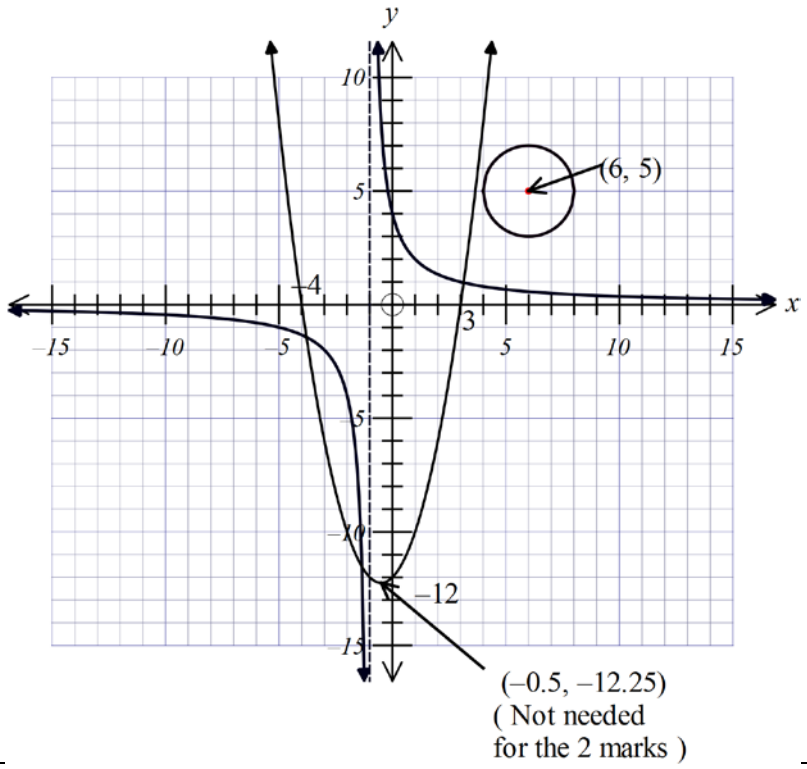
		Marks
76.	(a) The data is positively skewed.	1 mark for correct answer
	(b) $\text{mean} = \bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{186}{30} = 6.2$ pages Or using Stats function on calculator.	1 mark for correct answer
	(c) Interquartile range = 8.75 – 3.00 = 5.75  	1 mark for correct answer Allow within 0.25 of the upper and lower quartiles and hence error in the consequent answer.
	(d) Standard deviation = 4.07 (to 2 decimal places) From Stats function on calculator.	1 mark for correct answer

77.	(a) $\frac{2a^2+8a}{a^2+a-12} \times \frac{a^2+2a-15}{3a^3+15a^2} = \frac{2a(a+4)}{(a+4)(a-3)} \times \frac{(a+5)(a-3)}{3a^2(a+5)}$ $= \frac{2}{3a}$	2 marks for correct answer 1 mark for answer with working that shows some correct factorisations and simplifications.
	(b) $\frac{4k-3}{2} - 1 = 2(2k+1)$ $2 \times \frac{4k-3}{2} - 2 \times 1 = 2 \times 2(2k+1)$ $4k-3-2 = 8k+4$ $4k-5 = 8k+4$ $-4k-5 = 4$ $-4k = 9$ $k = \frac{9}{-4} = -2\frac{1}{4}$	2 marks for correct answer 1 mark for answer with working that shows some correct algebraic manipulation toward answer
78.	 In ΔBAE and ΔDCE $\angle ABE = \angle ECD$ (Alt $\angle$ on $\parallel$ lines) $\angle AEB = \angle CED$ (Vert opp $\angle$) $AE = CE$ (Two halves of bisector) $\therefore \Delta BAE \equiv \Delta DCE$ (AAS) $\therefore AB = CD$ (corresp sides in congruent Δs)	2 marks for a complete proof that includes all necessary steps and reasons where required. 1 mark for a proof that is incomplete, or has a minor error in reasoning or has reasons missing.
79.	(a) $\frac{EG}{\sin 110°} = \frac{12.5}{\sin 35°}$ $EG = \sin 110° \times \frac{12.5}{\sin 35°}$ $EG = 20.5\text{km}$ (nearest 100 m)	1 mark for correct answer

	(b) $\cos F = \dfrac{18.6^2 + 15.4^2 - 20.5^2}{2 \times 18.6 \times 15.4}$ $= 0.284$ $F = \cos^{-1}(0.284)$ $= 73°$ (nearest degree)	1 mark for correct answer
	(c) $\text{Area} = \dfrac{1}{2} \times 15.4 \times 18.6 \times \sin 73°$ $= 137 \text{ km}^2$ (nearest km)	1 mark for correct answer
80.	(a)  	1 mark for correct diagram with outcomes Greek letters included only for reference
	(b) Those with a blue included are marked β $P(\text{Blue included}) = \dfrac{5}{9}$	1 mark for correct answer
	(c) Those with a blue or red included but not both are marked γ $P(\text{Blue or Red included not both}) = \dfrac{6}{9} = \dfrac{2}{3}$	1 mark for correct answer

81.	 Sides which appear equal are *AC* and *BC*, so test these first. OR $AC = \sqrt{(8-6)^2 + (8--5)^2}$ $= \sqrt{(-2)^2 + (13)^2}$ $= \sqrt{4 + 169}$ $= \sqrt{173}$ $BC = \sqrt{(6--7)^2 + (-5--3)^2}$ $= \sqrt{(13)^2 + (-2)^2}$ $= \sqrt{169 + 4}$ $= \sqrt{173}$ $\therefore AC = BC$ $\therefore \Delta ABC$ is isosceles. $AC^2 = 2^2 + 13^2$ $= 4 + 169$ $= 173$ $AC = \sqrt{173}$ $BC^2 = 13^2 + 2^2$ $= 169 + 4$ $= 173$ $BC = \sqrt{173}$ $\therefore AC = BC$ $\therefore \Delta ABC$ is isosceles	2 marks for solution which shows two sides are equal and hence that the triangle is isosceles. Use of distance formula is preferred, but not essential. 1 mark for attempt to show sides equal using coordinate methods, with an error in calculation, or reasoning; for example if student finds gradients and uses this to show equal sides, whereas in fact it would show perpendicular sides.

82.	(a) $3x^2 - 6x - 1 = 0$ Does not factorise, so use the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{6 \pm \sqrt{36 - 4 \times 3 \times (-1)}}{2 \times 3}$ $x = \frac{6 \pm \sqrt{36 - -12}}{6}$ $x = \frac{6 \pm \sqrt{48}}{6}$ $x = \frac{6 \pm 4\sqrt{3}}{6}$ $x = \frac{3 \pm 2\sqrt{3}}{3}$	1 mark for correct answer of $x = \frac{6 \pm \sqrt{48}}{6}$ Simplest surd form is not needed for the mark, just supplied to compare with those who do go this far.
	(b) $4x - 5 = 3 + \frac{5}{x}$ $x \times 4x - x \times 5 = x \times 3 + x \times \frac{5}{x}$ $4x^2 - 5x = 3x + 5$ $4x^2 - 8x - 5 = 0$ $4x^2 - 10x + 2x - 5 = 0$ $2x(2x - 5) + 1(2x - 5) = 0$ $(2x - 5)(2x + 1) = 0$ $2x = 5$ or $2x = -1$ $x = 2\frac{1}{2}$ or $x = -\frac{1}{2}$	2 marks for both correct answers 1 mark for answer(s) with working that shows some correct algebraic manipulation toward answer.

83.		(a) 2 marks for correct shaped parabola, including the x and y intercepts, exact vertex not required. 1 mark if factorised incorrectly to obtain intercepts, or otherwise a minor error in calculation or drawing. (b) 1 mark for the correct circle with centre and radius correct. (c) 1 mark for (3.0, 1.0) (-1.5, -11.5) and (-4, -1.5) [also accept (-3.5, -1.5)]