Mark Scheme (Results)

Summer 2017

Pearson Edexcel International GCSE
In Mathematics B (4MB0) Paper 02R

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - awrt – answer which rounds to
  - eeoo – each error or omission

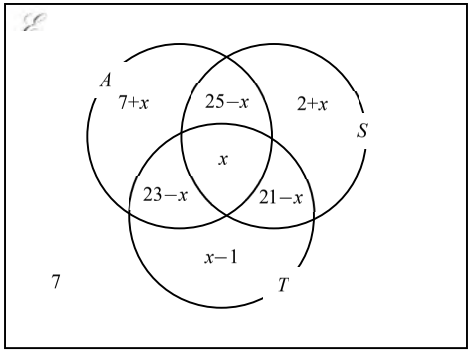
- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
  If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.
  If there is no answer on the answer line then check the working for an obvious answer.
- **Ignoring subsequent work**
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

Question	Working		Answer	Mark	Notes
1 (a)	$\frac{360}{2}\times(2+3+5)$				M1
			1800	2	A1
(b) (i)	$(y=)\ \frac{3}{10}\times$"1800" (=540)	$(z=)\ \frac{5}{10}\times$"1800" (=900)			M1 Calculation for either y or z Not retrospective (ie only award in (b) if used in (b))
	"540"×1.25				M1 (DEP)
			675 euros		A1
(ii)	"900"×1.25×1.2				M1 (DEP)
	(=1125x1.2)		1350 dollars	5	A1
					Total 7 marks

2	$(2x+3)(x+1)=(3x-5)(x+2)$			M1	Any correct equation.
	$2x^2+3x+2x+3=3x^2+6x-5x-10$			M1 (DEP)	Correctly expand either (quadratic) side.
	$x^2-4x-13(=0)$ (oe)			A1	cao
	$x=\frac{-(-4)\pm\sqrt{(-4)^2-4\times1\times(-13)}}{2\times1}$ (oe, completing the square ie "$(x-2)^2=17$")			M1 (INDEP)	ft if their quadratic has three non-zero terms.
	$x=\frac{4\pm\sqrt{68}}{2}$ or $x=2\pm\sqrt{17}$			M1 (DEP)	DEP on previous M1 ft for evaluating discriminant (ft if working seen and their discriminant is not negative.)
	NB: Some working must be seen else M0 M0 A0 if answer is incorrect.	6.12	6	A1 cao	DEP on third M1 Do not award if negative value is also given and not rejected.
					Total 6 marks

3 (a)		90°	1	B1	cao
(b)		45°	1	B1	cao
(c) (i)		68°		B1	cao
		corresponding angles		B1	
(ii)		$\angle CEB = 45^\circ$		B1	cao
		angles in same segment		B1	OR angles subtended by same arc
(iii)		$\angle EFB = 67^\circ$		B1	cao
		angles in triangle = 180°	6	B1	OR $\angle$s in Δ
(d)		136°	1	B1	cao
	NB: (1) Award marks if angles seen on diagram **(2)** Reasons must be **stated** clearly and not to be inferred from their working.				**Total 9 marks**

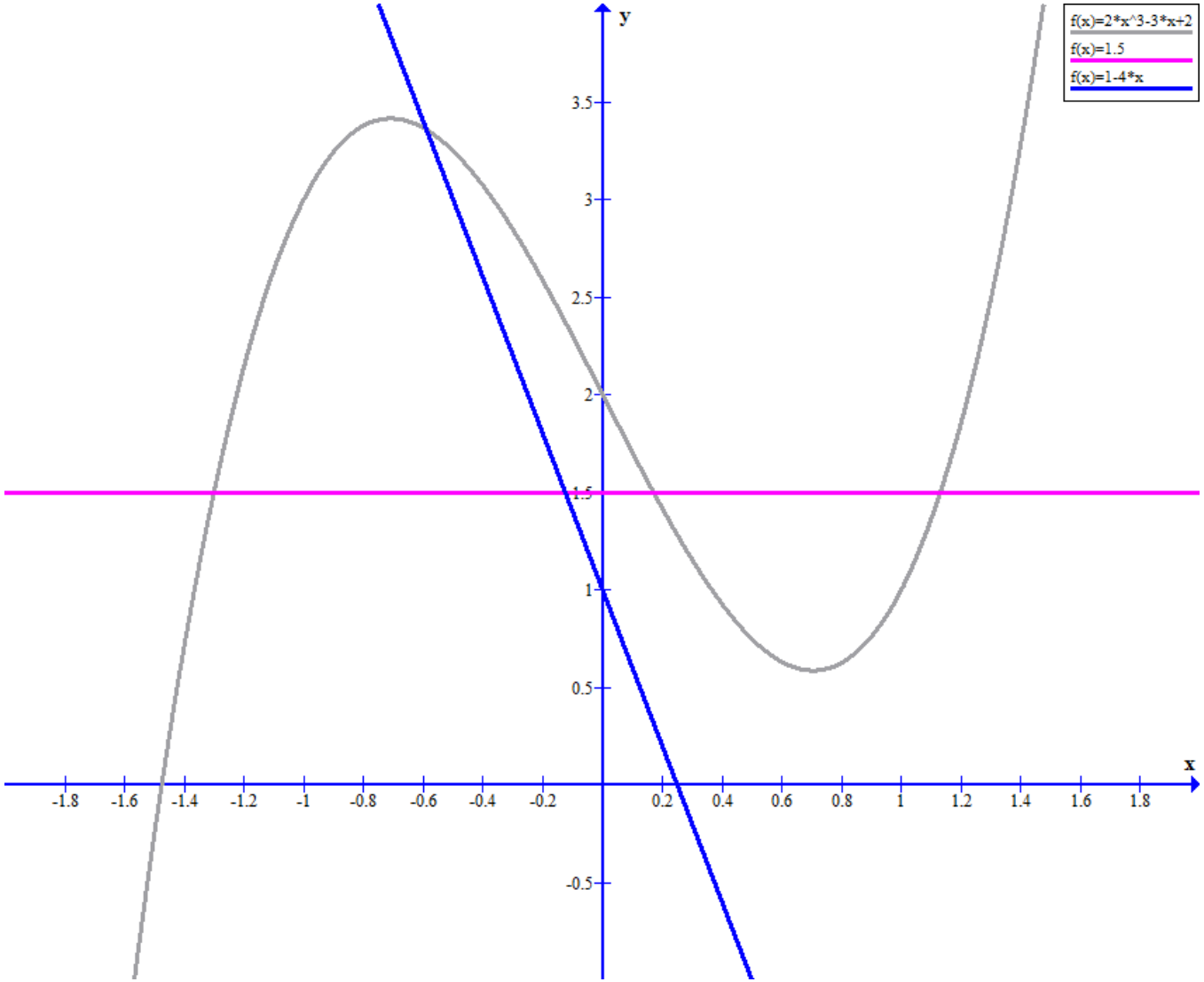
		Penalise nc ONCE only			
4	(a)	$AB^2 = 6^2 + 9^2 - 2\times6\times9\cos105$			M1
		$AB^2 = 117 - 108\cos105$ (= 117 +27.95 = 144.95)			M1 (DEP)
			12.0 cm (Accept 12)	3	A1 12.03962… at least 3SF
	(b)	$\frac{1}{2}\times6\times9\sin105$			M1
			26.1 cm^2	2	A1 26.07999… at least 3 SF
	(c)	$\frac{352}{"26.1"}$			M1
			13.5	2	A1 13.49693… at least 3 SF
	(d)	$(6+9+"12.0")\times"13.5"+2\times"26.1"$			M1
			417 cm^2	2	A1 417.112… at least 3 SF (or awrt 417 if nc has been penalised)
					Total 9 marks

5	(a)			3	B3 B2 for 4 correct entries added B1 for 2 correct entries added **NB:** Start entering marks starting with the 1st B box so B2 (out of 3) would be entered as 1 1 0
	(b)	$x+25-x+23-x+21-x+7+x+2+x+x-1+7=100$ (their 8 entries)			M1 ft Venn diagram
			16 (cao)	2	A1
	(c)	"$23-x$"+x+"$21-x$" or "(23−"16")"+"16"+"(21−"16")" **NB:** Numbers can be on Venn Diagram			M1 ft Venn diagram Do not condone negative members numbers
			28 (cao)	2	A1
	(d)		$\frac{5}{11}$ (cao)	1	B1 $\frac{25}{55}$, 0.454.., 0.455, 45.4%, 45.5%
					Total 8 marks

6	(a)	$14\times24+17\times22+20\times28+24\times20+29\times6$ (= 1924)			M1 M1(DEP)	3 correct fx products added Σfx for consistent x values in each interval (all correct) **NB:** Must use mid-values
		$\frac{1924}{100}$			M1 (DEP)	
			awrt 19.2 km/l	4	A1	So accept, eg, 19.24
	(b)	bars 16 – 18 height 11 cm (22 ss), 18 – 22 height 7 cm (14 ss), 26 – 32 height 1 cm (2 ss)	correct bars drawn	3	B3	B1 for each bar with correct width and height.
	(c)	$\frac{1}{4}\times20$ oe			M1	Method to find the number of cars in the interval $25 < x \leqslant 26$
			11 (cao)	2	A1	
		NB: Thus 5 → M1 A0				**Total 9 marks**

7	(a)		2000 dollars	1	B1	
	(b)	entrance fee = 1.2×8 (oe) (=9.6) visitors = 0.9×250 (oe) (=225)			M1	Complete method to find new entrance fee OR number of visitors.
		$1.2\times 8\times 0.9\times 250$			M1 (DEP)	
			2160 dollars	3	A1	
	(c)	entrance fee = $\frac{100+2r}{100}\times 8$ (=8 + 0.16r)			M1 (INDEP)	Complete method to find new entrance fee.
		visitors = $\frac{100-r}{100}\times 250$ (=250-2.5r)			M1 (INDEP)	Complete method to find new number of visitors.
		$(T=)\ \left(\frac{100+2r}{100}\times 8\right)\left(\frac{100-r}{100}\times 250\right)$ OR $(8\ +\ 0.16r)(250-2.5r)$ OR $0.2(100+2r)(100-r)$			M1 (DEP)	
		$0.2(10000-100r+200r-2r^2)$	$2000+20r-0.4r^2$ (cso)	4	A1	dep on M marks **Expansion of brackets must be shown.**
	(d)	$\frac{dT}{dr}=20-0.8r$	$-0.4(r^2-50r+5000)$ (ie rewriting)		M1	One term correct
		"$20-0.8r$"$=0$	$-0.4\left((r-25)^2+5000-625\right)$ ie completing the square		M1 (DEP)	Cand's derivative must be function of r
			25 (cao)	3	A1	
						Total 11 marks

8	(a)		3 0.75	2	B1 B1	
	(b)		Correct curve drawn	3	B3	−1 mark for each point missed/incorrectly plotted each point or segment missed straight line segments (penalise ONCE) tramlines (penalise ONCE) very poor curve **NB: FT** for (−1, "3") and (0.5, "0.75") Tol = $\pm\frac{1}{2}ss = \pm 0.025$
	(c)	$2x^3 - 3x + 2 = 1\frac{1}{2}$ **OR** $2x^3 - 3x + 2 = -2x^3 + 3x + 1$			M1	
			$-1.3, 0.2, 1.1$ (cao) Tol = $\pm 1ss = \pm 0.05$	3	A2	A1 for two correct (So in ePEN this is scored at 1 then 0)
	(d)	$2x^3 - 3x + 2 > 1 - 4x$			M1	condone "="
		Plot "$y = 1 - 4x$"			M1(INDEP)	ft (must be a straight line)
		-0.6			A1	ft from graph dep on above M1
			$x > -0.6$	4	A1	cao
			Tol = $\pm 1ss = \pm 0.05$ for **both** As above			**Total 12 marks**



9 (a) (i)		$4\mathbf{b}$		B1	
(ii)		"$4\mathbf{b}$" + $8\mathbf{a}$		B1ft	ft $4\mathbf{b}$ from (i)
(iii)		$4\mathbf{a} - 6\mathbf{b}$	3	B1	
(b) (i)		λ"$(4\mathbf{a} - 6\mathbf{b})$"		B1ft	ft $4\mathbf{a} - 6\mathbf{b}$ from (a)(iii)
(ii)	"$4\mathbf{b}$" + $4\mathbf{a}$ + "$\lambda(4\mathbf{a} - 6\mathbf{b})$" **OR** $-2\mathbf{b} + 8\mathbf{a} + (\lambda - 1)$"$(4\mathbf{a} - 6\mathbf{b})$"	$4(\lambda+1)\mathbf{a} + (4 - 6\lambda)\mathbf{b}$	2	B1ft	ft $\lambda(4\mathbf{a} - 6\mathbf{b})$ from (i) OR (a)(iii) Simplification **NOT** required.
(c)		μ"("$4\mathbf{b}$" + $8\mathbf{a}$)"	1	B1ft	ft $4\mathbf{b} + 8\mathbf{a}$ from (a)(ii)
(d)	"$4(\lambda+1)\mathbf{a} + (4 - 6\lambda)\mathbf{b}$" = "$\mu(4\mathbf{b} + 8\mathbf{a})$" "$4+4\lambda = 8\mu$" **and** "$4 - 6\lambda = 4\mu$"			M1 M1(DEP)	ft on (b)(ii) and (c) ft
	$-4 + 16\lambda = 0$ or $20 = 32\mu$			M1	ft eliminate either variable
	NB: If just one of $\lambda = \frac{1}{4}$ or $\mu = \frac{5}{8}$ and no working seen, score 4 / 5 marks	$\lambda = \frac{1}{4}$, $\mu = \frac{5}{8}$	5	A1 cso A1 cso	
(e) (i)		20		B1 cao	
(ii)		5	2	B1 cao	
					Total 13 marks

10	(a)	$\left(2^{3x}\right)^{x-2} = 2^{3x^2-6x}$			M1	Multiply indices
		$\frac{12\times 6^{2x-1}}{9^x} = \frac{2^2\times 3\times 2^{2x-1}\times 3^{2x-1}}{\left(3^2\right)^x}$ **OR** $\frac{3\times 2^2\times 2^{3x(x-2)}\times 2^{2x-1}\times 3^{2x-1}}{3^{2x}}$			M1 (M1) (M1(DEP))	Express 12, 6 and 9 as products of 2 and 3. Factors of 2 OR 3 separated Factors of 2 AND 3 separated
			$n = 3x^2 - 4x + 1$ Accept 2^{3x^2-4x+1}	3	A1	**cso**
	(b)	$3x^2 - 4x + 1 = 5$			M1	(really a B1)
		$(3x+2)(x-2) = 0$			M1(INDEP)	or correct use of formula **NB:** Attempt on their 3 term quadratic
			$x = -\frac{2}{3}$ **and** $x = 2$ (cao)	3	A1	
						Total 6 marks

11	(a)		(1, 2), (3, 2), (3, 1)	1	B1	Coordinates or column vectors, any order
	(b)		Rotation 270° centre (0, 0)	3	B1 B1 B1	 or –90° or 90° clockwise or *O* or origin
	(c)		$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	1	B1	
	(d)	$\begin{pmatrix} -1 & -2 \\ 0 & 2 \end{pmatrix}$"$\begin{pmatrix} 1 & 3 & 3 \\ 2 & 2 & 1 \end{pmatrix}$" **NB: Order is important**			M1	ft from (a) for three correct entries Columns could be in any order.
			(−5, 4), (−7, 4), (−5, 2)	2	A1 cao	Accept $\begin{pmatrix} -5 & -7 & -5 \\ 4 & 4 & 2 \end{pmatrix}$ with columns in any order.
	(e)	$\begin{pmatrix} -1 & -2 \\ 0 & 2 \end{pmatrix}$"$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$" **NB: Order is important** **OR** $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} -2 & -1 & -2 \\ 1 & 3 & 3 \end{pmatrix}$="$\begin{pmatrix} -5 & -5 & -7 \\ 4 & 2 & 4 \end{pmatrix}$" **NB:(1) Order** of coords important TWO correct eqns in *a* and *b* from "above" **AND** TWO correct eqns in *c* and *d* from "above" Answer (cao)			M1 (M1) (M1 (DEP)) (A1)	ft from (c) ft from (d)

		$\begin{pmatrix} 2 & -1 \\ -2 & 0 \end{pmatrix}$	3	M1 A1	ft their *correct* product of *their* 2x2 matrices cao
					Total 10 marks

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