edexcel

Mark Scheme (Results)

January 2015

Pearson Edexcel International GCSE

Mathematics A (4PM0)

Paper 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2015
Publications Code UG040559

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)
    - ep – dependent
    - indep – independent
    - 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 always check the working in the body of the script 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 two A (or B) marks on that part, but can gain the M marks. Mark all work on follow through but enter A0 (or B0) for the first two A or B marks gained.

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 are multiple attempts shown, then all attempts should be marked and the highest score on a single attempt should be awarded.

- **Follow through marks**
  Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.
  Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.
- **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 shows that the candidate did not understand the demand of the question.
- **Linear equations**
  Full marks can be gained if the solution alone is given, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

General Principles for Further Pure Mathematics Marking
(but note that specific mark schemes may sometimes override these general principles)

Method mark for solving a 3 term quadratic equation:

1. Factorisation:

$(x^2 + bx + c) = (x + p)(x + q)$ where $|pq| = |c|$

$(ax^2 + bx + c) = (mx + p)(nx + q)$ where $|pq| = |c|$ and $|mn| = |a|$

2. Formula:

Attempt to use the **correct** formula (shown explicitly or implied by working) with values for *a*, *b* and *c* . If there are errors in substitution, the correct formula must be seen to award an M mark.

3. Completing the square:

Solving $x^2 + bx + c = \left(x \pm \frac{b}{2}\right)^2 \pm q \pm c$ where $q \neq 0$

Method marks for differentiation and integration:

1. Differentiation

Power of at least one term decreased by 1.

2. Integration:

Power of at least one term increased by 1.

Use of a formula:

Generally, the method mark is gained by:
either quoting a correct formula and attempting to use it, even if there are slight mistakes in the substitution of values,
or, where the formula is not quoted, the method mark can be gained by implication from the substitution of correct values and then proceeding to a solution.

Answers without working:

The rubric states "Without sufficient working, correct answers may be awarded no marks".
General policy is that if it could be done "in your head" detailed working would not be required. (Mark schemes may override this eg in a case of "prove or show...."

Exact answers:

When a question demands an exact answer, all the working must also be exact. Once a candidate loses exactness by resorting to decimals the exactness cannot be regained.

Rounding answers (where accuracy is specified in the question)

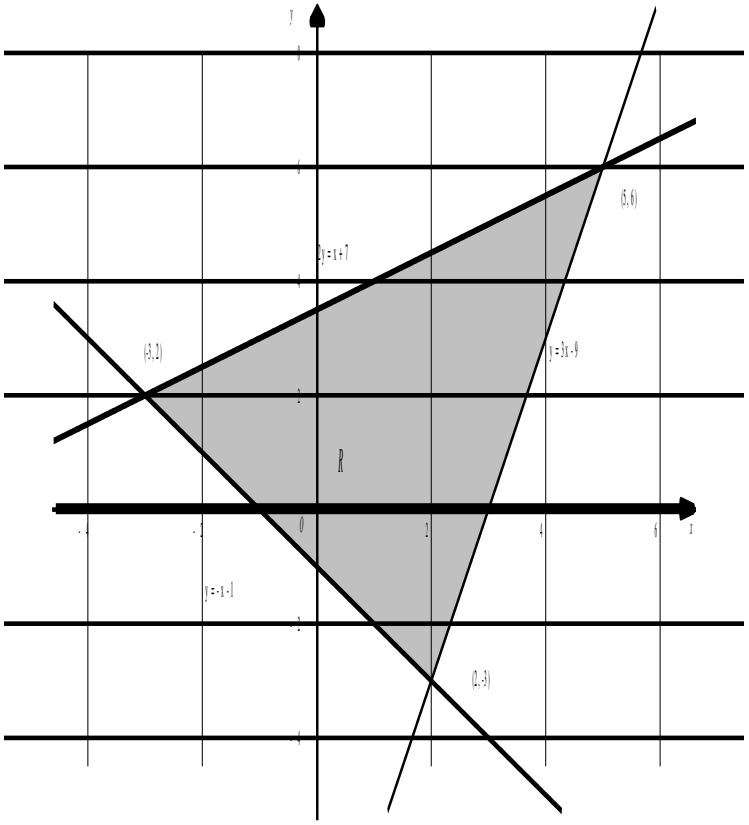
Penalise only once per question for failing to round as instructed - ie giving more digits in the answers. Answers with fewer digits are automatically incorrect, but the isw rule may allow the mark to be awarded before the final answer is given.

Question		Working	Mark	Notes
1.	(a)	$A = \frac{1}{2}x^2 \sin 60^\circ = \frac{1}{2}x^2 \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{4}x^2$	2	M1 A1
	(b)	$\frac{dA}{dx} = \frac{\sqrt{3}}{2}x$ $\frac{dA}{dt} = \frac{dA}{dx} \times \frac{dx}{dt}, \Rightarrow \frac{\sqrt{3}}{10} = \frac{\sqrt{3}}{2}x \times 0.1$ $x = 2$	4	B1 oe M1 M1d A1
				Total 6 Marks

Question		Working	Mark	Notes
2.	(a)	1.4 (m)	1	B1
	(b)	$v = \frac{ds}{dt} = 19.6 - 9.8t$ when $t = 0$, $v = 19.6$ (m/s)	2	M1 A1
	(c)	$(-)9.8(\text{m/s}^2)$	1	B1 ft
	(d)	$19.6 - 9.8t = 0 \Rightarrow t = 2$ $s = 1.4 + 19.6 \times 2 - 4.9 \times 2^2 = 21$ (m)	3	M1 M1d A1
				Total 7 Marks

Question		Working	Mark	Notes
3.	(a)	$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$	1	B1
	(b)	$\overrightarrow{PQ} = \frac{1}{2}\mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a}) = \frac{1}{2}\mathbf{b}$ $(\mu = \frac{1}{2})$	2	M1 A1
	(c)	$\overrightarrow{RC} = (1-\lambda)(\mathbf{c} - \mathbf{b})$ **OR** $\overrightarrow{OR} = \mathbf{b} + \lambda(\mathbf{b} - \mathbf{c})$ $\overrightarrow{SR} = (1-\lambda)\mathbf{c} - (1-\lambda)(\mathbf{c} - \mathbf{b})$ **OR** $\overrightarrow{SR} = -\lambda\mathbf{c} + \mathbf{b} + \lambda(\mathbf{c} - \mathbf{b})$ $= (1-\lambda)\mathbf{b}$ $\overrightarrow{SR} = 2(1-\lambda)\overrightarrow{PQ}$ (*or* both $\overrightarrow{SR}$ and $\overrightarrow{PQ}$ are multiples of $\mathbf{b} \Rightarrow PQ \parallel SR$)	4	M1 oe M1 oe A1 A1
	(d)	$\frac{1}{2}\mathbf{b} = 1\frac{1}{2}(1-\lambda)\mathbf{b}$ $1 = 3(1-\lambda) \Rightarrow \lambda = \frac{2}{3}$	2	M1 A1
				Total 9 Marks

Question		Working	Mark	Notes
4.	(a)	$l = 5 \times 1.8 = 9$ (cm)	1	B1 awrt
	(b)	$A = \frac{1}{2} \times 5^2 \times 1.8 = 22.5$ (cm^2) **OR** $A = \frac{1}{2} \times 5 \times 9 = 22.5$ (cm^2)	2	M1 A1 awrt
				Total 3 Marks

<table>
<tr><th>Question</th><th>Working</th><th>Mark</th><th>Notes</th></tr>
<tr><td>5. (a)</td><td> 
</td><td>4</td><td>M1 Any line or accurate method to find a line
A1 1 correct line
A1 2 correct lines
A1 3 correct lines</td></tr>
<tr><td>(b)</td><td>Show region</td><td>1</td><td></td></tr>
<tr><td>(c)</td><td><table>
<tr><td>Vertex</td><td>(-3, 2)</td><td>(5, 6)</td><td>(2, -3)</td></tr>
<tr><td>$P = y - 2x$</td><td>8</td><td>-4</td><td>-7</td></tr>
<tr><td></td><td>Greatest</td><td></td><td>Least</td></tr>
</table></td><td>4</td><td>M1
M1d A1
A1</td></tr>
<tr><td></td><td></td><td></td><td>Total 9 Marks</td></tr>
</table>

Question	Working	Mark	Notes
6. (a)	$\log 3^z = \log 4$ $z = \dfrac{\log 4}{\log 3} = 1.26$	3	M1 M1 A1
(b)	$(3^y)^2 - 13(3^y) + 36 = 0$ $(3^y - 4)(3^y - 9) = 0$ $3^y = 4$ or $3^y = 9$ $y = 1.26$ or $y = 2$	4	M1 M1 A1 A1
(c)	$3^x 2^x - 3^x - 4(2^x) + 4 = 0$ $(3^x - 4)(2^x - 1) = 0$ $3^x = 4$ or $2^x = 1$ $x = 1.26$ or $x = 0$	5	M1 M1d M1dd A1 A1
			Total 12 Marks

Question	Working	Mark	Notes
7. (a)	$V = \pi\int_0^4 (x^2+3)^2 \mathrm{d}x$ $= \pi\int_0^4 (x^4+6x^2+9)\mathrm{d}x$ $= \pi\left[\frac{1}{5}x^5+2x^3+9x\right]_0^4$ $= \pi\left(\frac{1024}{5}+128+36\right)-0$ $= 368.8\pi = 1158.6$	6	M1 A1 M1 A1 Allow absence of pi M1d A1

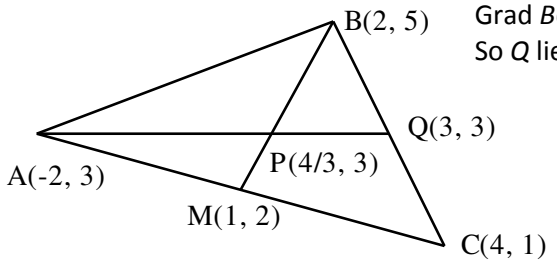
(b)	Area below chord = $\frac{1}{2}(3+19)4 = 44$	6	B1
	Area below arc = $\int_0^4 (x^2+3)dx$		M1
	$= \left[\frac{1}{3}x^3 + 3x\right]_0^4$		A1
	$= \left(\frac{64}{3} + 12\right) - 0$		M1d
	$= 33\frac{1}{3}$		A1
	Area between chord and arc = $44 - 33\frac{1}{3} = 10\frac{2}{3}$		A1 Ft, awrt
	OR		**OR**
	equation AB is $y = 4x+3$		B1
	Area between chord and arc = $\int_0^4 \left[(4x+3)-(x^2+3)\right]\mathrm{d}x$		M1
	$= \int_0^4 \left[(4x-x^2)\right]\mathrm{d}x$		
	$= \left[2x^2 - \frac{1}{3}x^3\right]_0^4$ *or* $\left[(2x^2+3x)-(\frac{1}{3}x^3+3x)\right]_0^4$		A1
	$= 2\times4^2 - \frac{1}{3}\times4^3 = 32 - \frac{64}{3}$ *or* $= 32+12-\frac{64}{3}-12$		M1d A1
	$= 10\frac{2}{3}$		A1 Ft, awrt
			Total 12 Marks

Question	Working	Mark	Notes
8. (a)	$1+\tan^2\theta = 1+\dfrac{\sin^2\theta}{\cos^2\theta}$ $= \dfrac{\cos^2\theta+\sin^2\theta}{\cos^2\theta} = \dfrac{1}{\cos^2\theta}$ *	3	M1 M1 A1
(b)	$\dfrac{1+\sin\theta\cos\theta+\sin^2\theta}{\cos^2\theta} = \dfrac{1}{\cos^2\theta}+\dfrac{\sin\theta\cos\theta}{\cos^2\theta}+\left(\dfrac{\sin\theta}{\cos\theta}\right)^2$ $= 1+\tan^2\theta+\tan\theta+\tan^2\theta = 1+\tan\theta+2\tan^2\theta$ *	3	M1 M1 A1
(c)	$1+\sin\theta\cos\theta+\sin^2\theta = 4\cos^2\theta$ $\dfrac{1+\sin\theta\cos\theta+\sin^2\theta}{\cos^2\theta} = 4$ $1+\tan\theta+2\tan^2\theta = 4$ $2\tan^2\theta+\tan\theta-3=0$ $(2\tan\theta+3)(\tan\theta-1)=0$ $\tan\theta = -\frac{3}{2}$ or $\tan\theta = 1$ $\theta = 123.7^\circ$ or $\theta = 45^\circ$	6	 M1 A1 M1 A1 A1 Either value, awrt A1 Both values rounded correctly
			Total 12 Marks

Question	Working	Mark	Notes
9. (a)	$2+a+b+15=-12$ and $-2+a-b+15=48$ $a+b=-29$ and $a-b=35$ $2a=6$ and $2b=-64$ $a=3$ and $b=-32$	6	 M1 A1 A1 M1 Either A1 Either value A1 Both values
(b)	$f(\frac{1}{2})=2(\frac{1}{2})^3+3(\frac{1}{2})^2-32(\frac{1}{2})+15=\frac{1}{4}+\frac{3}{4}-16+15=0$ *	1	B1
(c)	$f(x)=(2x-1)(x^2+2x-15)$ $=(2x-1)(x+5)(x-3)$	4	M1 A1 M1 A1
(d)	$x=\frac{1}{2}$ $x=-5$ $x=3$	1	B1 ft
			Total 12 Marks

Question	Working	Mark	Notes
10. (a)	Gradient of $AB = \frac{5-3}{2+2} = \frac{2}{4}$, gradient of $BC = \frac{5-1}{2-4} = \frac{4}{-2}$ Product of gradients $= \frac{2}{4} \times \frac{4}{-2} = -1 \Rightarrow AB \perp BC$ * **OR** $AB^2 = (5-3)^2 + (2+2)^2$ and $BC^2 = (5-1)^2 + (2-4)^2$ $AC^2 = (-2-4)^2 + (3-5)^2 = 40$	3	M1 A1 oe A1 **OR** M1 A1 A1
(b)	$AB^2 = (5-3)^2 + (2+2)^2$ and $BC^2 = (5-1)^2 + (2-4)^2$ $\Rightarrow AB^2 = 4+16\ (=20)$ and $BC^2 = 16+4\ (=20)$ $\Rightarrow AB^2 = BC^2 \Rightarrow AB = BC$	3	M1 A1 A1
(c)	$M(1, 2)$	1	B1
(d)	Since $\angle ABC = 90^o$, AC is diameter of circle through A, B and C, so AM (*or CM or BM*) is radius (*or M* is centre of circle). $AM = \sqrt{(3-2)^2 + (-2-1)^2}$ or $CM = \sqrt{(1-2)^2 + (4-1)^2}$ or $BM = \sqrt{(2-1)^2 + (5-2)^2}$ or $r = \frac{1}{2}AC = \frac{1}{2}\sqrt{(-2-4)^2 + (3-1)^2}$ $r = \sqrt{10}$	3	M1 M1 A1
(e)	$P\left(\frac{2\times1+2}{3}, \frac{2\times2+5}{3}\right) = \left(\frac{4}{3}, 3\right)$	2	B1 B1

(f)	$Q(a, b)$ $\quad a = -2 + \frac{3}{2}\left(\frac{4}{3} - -2\right)$ $\frac{4}{3} = \frac{2a-2}{3}$ and $3 = \frac{2b+3}{3}$ $a = 3$ and $b = 3$ **OR** $Q\left(\frac{3\times\frac{4}{3}-1\times-2}{2}, \frac{3\times3-1\times3}{2}\right)$ $Q(3, 3)$	3	M1 A1 A1 **OR** A1 A1

(g)	Mid-pt of BC is $\left(\frac{2+4}{2}, \frac{5+1}{2}\right)$ $= (3, 3)$ **OR** BC has equation $y-5=-2(x-2)$ when $x=3$, $y=5-2(3-2)=3$ **OR** Grad $BQ=\frac{5-3}{2-3}=-2$, Grad $BC=\frac{5-1}{2-4}=-2$, Grad $QC=\frac{3-1}{3-4}=-2$  Grad BQ = Grad BC = Grad QC So Q lies on BC.	3	M1 A1 A1 **OR** M1 A1 A1 **OR** M1 A1 A1
			Total 18 Marks

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE