Countdown to your final Maths exam … part 9 (2018)

Examiners Report & Markscheme

Mark Scheme

Q1.

Question		Working	Answer	Mark	Notes
			230	2	M1 for 180 + 50 A1 cao **OR** M1 for 360 – (180 – 50) or 360 – 130 A1 cao **OR** M1 for 50 + (90 – 50) + 90 + 50 or 50 + 40 + 90 + 50 A1 cao **OR** M1 for a suitable diagram (sketch) with bearing of lighthouse from ship indicated and 50° marked at lighthouse; diagram only intended to indicate position of 50°; ignore other labels and markings unless they create ambiguity. A1 cao

Q2.

5MB3H/01 June 2015				
Question	**Working**	**Answer**	**Mark**	**Notes**
		85.6	4	M1 for 360 ÷ 5 (=72) M1 (dep) for $\frac{1}{2} \times 6^2 \times \sin\text{"72"}$ (=17.12) M1 for completing full method to find total area of pentagon A1 for 85.5 − 85.6 OR M1 for 360 ÷ 10 (=36) or $\frac{1}{2}(180 - 360 \div 5)$ (=54) M1(dep) for eg $6 \times \sin\text{"36"} \times 6 \times \cos\text{"36"}$ (=17.12) or $\frac{1}{2}\ 6 \times \sin\text{"54"} \times 6 \times \cos\text{"54"}$ (=8.55) M1 for completing full method to find total area of pentagon A1 for 85.5 − 85.6

Q3.

Question		Working	Answer	Mark	Notes
*	(a)			1	C1 for a complete reason eg <u>Angles</u> in a <u>semicircle</u> are <u>90°</u>, <u>alternate segment</u> theorem
	(b)		2.75	4	M1 for 7 × sin 35 M1 for 7 × sin 35 × 2 M1 (indep) for "*DB*"× cos 70 A1 2.74 - 2.75

Q4.

PAPER: 5MB3F_01					
Question		Working	Answer	Mark	Notes
	(a)		145	1	B1 accept 143 – 147
	(b)		7 – 9	4	M1 for carrying out a correct measurement of one of the lines eg (AC as) 10.3 – 10.7 or (BC as) 7.8 – 8.2 or (AB as) 6.3 – 6.7 M1 for scaling at any stage (by ×2) M1 for complete process of lengths AC – (AB + BC) ; scaled or unscaled A1 for answer in range 7 – 9

Q5.

PAPER: 5MB2H_01					
Question		Working	Answer	Mark	Notes
	(i)		126	2	B1 cao
	(ii)		Reason		B1 for reason relating to geometrical property & parallel lines which is not contradicted by method shown elsewhere eg alternate angles are equal, corresponding angles are equal, allied angles / co-interior angles add up to 180°

Q6.

		Working	Answer	Mark	Notes
*			35° with reasons	4	M1 for correct method to find one angle eg 70 or 110 (angles could be on the diagram) M1 for a complete correct method to work out *x* A1 (dep on M1) for 35° C1 for complete geometric reasons for their chosen method without extras eg exterior angle = sum of interior opposite angles **and** base angles of an isosceles triangle are equal OR angles in a triangle add up to 180 **and** angles on a straight line add up to 180 **and** base angles of an isosceles triangle are equal OR M1 $x + x + 20 + 90 = 180$ M1 for a complete correct method to work out *x* A1 (dep on M1) for 35° C1 for complete geometric reasons for their chosen method without extras eg angles in a triangle add up to 180 **and** base angles of an isosceles triangle are equal

Q7.

Question		Working	Answer	Mark	Notes
	(a)		150	2	M1 for 180 – (360 – 330) or 180 – 30 or 330 – 180 or a complete diagram showing the bearing of 330° A1 cao
	(b)		11 40	4	M1 for 200 ÷ 120 (=1 2/3 h) M1 for conversion between hours and minutes A1 for 1 h 40 min or 100 minutes B1 (ft dep on M1) for 11 40

Q8.

		Working	Answer	Mark	Notes
			110	2	M1 for 30 + 70 + 20 (=120) or 50 + 40 + 20 (=110) or 50 + 10 + 60 (=120) A1 cao

Q9.

PAPER: 1MA0_2H					
Question		**Working**	**Answer**	**Mark**	**Notes**
27			43.9	5	M1 for $\frac{11}{\sin 100} = \frac{9}{\sin D}$ oe M1 for $\sin D = \frac{9\sin 100}{11}$ (=0.80575…) or D = 53.68… M1 for angle DCA= 180 – 100 – "D" (=26.317..) M1 for area of $ABCD$ = 2 × ½ × 11 × 9 × sin"26.317" A1 for 43.8 – 43.9 **OR** M1 for $\frac{11}{\sin 100} = \frac{9}{\sin D}$ oe M1 for $\sin D = \frac{9\sin 100}{11}$ (=0.80575…) or D = 53.68… M1 for (height=) 9 × sin (180 – 100 – "D") or height = 3.990… M1 for area of $ABCD$ = (2 × ½) × 11 × "height" A1 for 43.8 – 43.9 **OR** M1 for $11^2 = AD^2 + 9^2 - 2\times AD\times 9\times\cos 100$ M1 for $AD = \frac{18\cos 100 + \sqrt{(18\cos 100)^2 - 4(1)(-40)}}{2(1)}$ M1 for $AD = \frac{18\cos 100 + \sqrt{169.7(69795...)}}{2(1)}$ (= 4.95195(…)) M1 for area of $ABCD = 2 \times \frac{1}{2} \times$ "4.95195" × 9 × sin100 A1 for 43.8 – 43.9

Q10.

PAPER: 1MA0_1F					
Question		**Working**	**Answer**	**Mark**	**Notes**
*		base angles of isosceles triangle are equal **and** angles on a straight line add up to 180° **and** angles in a triangle add up to 180° OR base angles of isosceles triangle are equal **and** angles in a triangle add up to 180° OR base angles of isosceles triangle are equal **and** exterior angle of a triangle is equal to the sum of the interior opposite angles	60° with reasons	4	B1 for angle ADB =25 can be shown on the diagram M1 for a complete method to find x C2 (dep 2 previous marks) for 60 with full reasoning seen (C1 (dep 1 previous mark) for one reason) QWC: Reasons must be appropriate to the method shown.

Q11.

Question		Working	Answer	Mark	Notes
			30.1	4	M1 for a correct trigonometric statement to find an unknown angle, eg. sin(30+x) or cos $A = \frac{10.4+5.2}{18}$ or $\frac{\sin ADC}{18} = \frac{\sin 30}{10.4}$ M1 for a complete method to find the angle, eg. $\sin^{-1}\left(\frac{10.4+5.2}{18}\right)$ (= 60.07...) or $\cos^{-1}\left(\frac{10.4+5.2}{18}\right)$ (= 29.92..) or $\sin^{-1}\left(\frac{18\times\sin 30}{10.4}\right)$ (= 59.92.. or 180 – 59.92.. = 120.07..) M1 (dep on M2) for a fully complete method to find angle x, eg. "60.07.". – 30 or 60 – "29.92.." or 90 – "59.92.." A1 for answer in the range 30.07 to 30.1 OR M1 for (BC^2=) $18^2 - (10.4 + 5.2)^2$ or $BC^2 + (10.4 + 5.2)^2 = 18^2$ M1 for (BC =) $\sqrt{18^2 - (10.4+5.2)^2}$ (= 8.97...) M1 (dep on M2) for a fully complete method to find angle x, eg. $\tan^{-1}\left(\frac{5.2}{\text{"8.97..."}}\right)$ A1 for answer in the range 30.07 to 30.1

Q12.

		Working	Answer	Mark	Notes
			36	4	M1 for 360 ÷ 5 (=72) or (2×5 – 4)×90 (=540) or (5−2)×180 (=540) M1(dep) for 180 – "72" (=108) or 540 ÷ 5 (=108) (could be marked on the diagram) M1 for complete method to find angle *HAB* (360 – 2 × "108") ÷ 2 oe or angle *EAH* + angle *HCD* 540 – ("108" + "108" + (360 – "108")) oe or angle *EAF* 720 – ("108" × 4) ÷ 2 oe A1 cao

Q13.

Question		Working	Answer	Mark	Notes
		AB = 5 sin 36 = $5/AD$ $AD = 5/\sin 36$ Or sin 36 = $5/BC$ $BC = 5/\sin 36$ $AD = BC$ OR cos 54 = $5/BC$ BC = 5/cos54	8.51	4	B1 AB = 5 M1 sin 36 = $5/AD$ or $\sin 36/5 = \sin 90/AD$ M1 $AD = 5/\sin 36$ or $AD = 5\sin 90/\sin 36$ A1 8.5 – 8.51 OR M1 sin 36 = $5/BC$ or $\sin 36/5 = \sin 90/BC$ M1 $BC = 5/\sin 36$ or $BC = 5\sin 90/\sin 36$ B1 AD ='BC' A1 8.5 – 8.51 OR B1 angle DCB = 54 or angle DBC = 36 M1 cos 54 = $5/BC$ M1 BC = 5/cos54 A1 8.5 – 8.51 NB other methods such as tan + Pythagoras must be complete methods and will earn M2

Q14.

5MB2H/01 June 2015				
Question	Working	Answer	Mark	Notes
*		27	4	M1 for 360÷5 (=72) or 360÷8 (=45) M1 for '72' – '45' A1 for $x = 27$ C1 (dep on M1) for sum of exterior angles of polygon is 360 degrees oe OR M1 for 3×180÷5 (=108) or 6×180÷8 (=135) M1 for '135' – '108' A1 for $x = 27$ C1 (dep on M1) for sum of interior angles of polygon is 180(n - 2) oe degrees or angles in a triangle sum to 180 degrees OR M1 for 360÷8 (=45) or 3×180÷5 (=108) M1 for 180 – ('108'+'45') A1 for $x = 27$ C1 (dep on M1) for sum of exterior angles of polygon is 360 degrees oe and angles on a straight line sum to 180 degrees

Q15.

		Working	Answer	Mark	Notes
	(a)		11.5	3	M1 for $13^2 - 6^2$ or 169 – 36 or 133 M1 (dep on M1) for $\sqrt{"13^2 - 6^2"}$ **or** $\sqrt{133}$ A1 for answer in the range 11.5 – 11.6
	(b)		47.2	3	M1 for cos (*RPQ*)=$^{17}/_{25}$oe **OR** sin *PQR* = $^{17}/_{25}$ with *PQR* clearly identified M1 for (*RPQ* =+) $\cos^{-1}$ $^{17}/_{25}$oe **OR** *PQR* = $\sin^{-1}$ $^{17}/_{25}$ with *PQR* clearly identified A1 for answer in the range 47.1 – 47.2 SC : B2 for an answer of 0.823(033...) **or** 52.3(95...) **or** 52.4

Examiner's Report

Q1. Some candidates attempted this question with a diagram, either a sketch or scaled. In very few cases did this approach help them, since there was clearly little understanding of bearings as drawn clockwise from a north line. It was also common to see reflex angles drawn as obtuse, and vice versa. The most common incorrect answer was 310°, from 360° – 50°. Other common errors involved confusion of the relative location of the ship and the lighthouse.
Overall, this was a poorly answered question showing bearings as a general weakness.

Q2. This question was well attempted by students and it was rare to see blank responses, though the weaker students often gained no marks as they were unable to correctly find a useful angle. Some of these realised that they needed to use ½ ab sin C but were incorrectly calculating ½ × 6 × 6 sin 54 or ½ × 6 × 6 sin 60. Although many were successful when using trigonometry to find the height and base of a triangle and then ½ × base × height to find the triangle's area, this method frequently led to lost marks, sometimes just the accuracy mark due to premature rounding and sometimes all but the first method mark, due to assuming the edges of the pentagon, and hence the base of the triangle, was also 6m.

Q3. Both parts seemed to be beyond many students entered for this exam. Part (a) was a test of knowledge of circle theorems. Students could answer by using the classical 'The angle in a semi circle is a right angle' but reference to the alternate segment theorem was also accepted.
In part (b) students were expected to use sine to find the opposite, then double to get the diameter followed by using cosine to get the required length. Many students clearly had no knowledge of trigonometry so scored no marks. Others showed confusion between sine, cosine and tangent and also generally scored no marks. Some lost a mark because of premature approximation – they truncated 8 sin35° to 4, so their diameter was 8 and 8cos70° was outside the allowed tolerance. This also tended to happen for those who used a combination of cosine and Pythagoras's Theorem in triangle *ABO* and a combination of sine and Pythagoras's Theorem in triangle *DBC*, although they could earn the three method marks.

Q4. Candidates often struggle with bearings and this year was no exception with candidates being unsure of which angle to measure. Part (b) was tackled well with most candidates measuring at least one of the distances correctly in cm and then converting this correctly to km scoring at least 2 marks. Many then went on to produce a final answer between 7 and 9 from correctly measuring all 3 distances.

Q5. Generally this question was done well. In part (i), most candidates were able to find the size of the required angle either directly or by initially finding some or all of the other angles in the diagram. A common incorrect answer here was 104. In part (ii), a significant number of candidates were unable to give a correct reason using the properties of parallel lines. A common incorrect answer was "opposite angle are equal".

Q6. This question wasn't answered as well as expected, bearing in mind that this type of question has been in the last few exam series. Finding 70° seemed to be quite easy; most candidates who found 70° knew which angle it applied to, but following it with a complete method to find *x* was rare.

Candidates are getting better at using the correct terminology, as the reasoning for angles in a triangle and angles on a straight line was often correct. However, candidates are still struggling to gain the communication by not giving **complete** explanations of their reasoning. Parallel lines were often mentioned despite not being present.

> **Results Plus: Examiner Tip**
> Candidates should be given regular access to mathematical notation.

Q7. There were very few correct answers in part (a). Many students gave answers of 330° or 30° without working. Working accompanying 30° came from 360°- 330°. Very few students drew a diagram; those who did often left out one of the north lines.

In part (b) many students tried to break down the distance and speed obtaining 1 hour for 120 miles and trying to find the time needed for the remaining 80 miles. Unfortunately this method was often unsuccessful due to arithmetic errors. One mark was awarded for 200 ÷ 120 but this often resulted in an incorrect decimal (eg 1.8) which was converted incorrectly. However some marks were available when time conversions were done correctly. Some students tried to use the speed, distance and time formula but used 10 as the time. This often resulted in (10 × 120) ÷ 200. Another common error was to calculate 200 × 120. A small number of students spoiled an otherwise correct response by failing to give an actual time of arrival, giving instead the duration.

Q8. Most candidates were able to find the shortest route between Ambel and Ford. Many candidates attempted only one of the possible routes between the two towns often resulting in the common incorrect answer 120. Another common incorrect answer was 10, the shortest distance in the diagram. Some candidates, having calculated the three shortest routes between Ambel and Ford did not identify explicitly the shortest of these routes.

Q9. This question discriminated well, even amongst the most able candidates. Of those who were successful the most common start to solving this problem was using the Sine rule to find the angel at D. In cases where candidates

failed to score any marks attempts at Pythagoras or trigonometry for right angled triangles were commonly seen, of those who did recognise the need for formulas for non-right angled triangles they proceeded to misapply the values to the cosine rule or substitute the given values into the formula ½ ab Sin C, showing a lack of understanding of the included angle.
Some clearly able candidates worked out the required information using trigonometry but then thought the area of the parallelogram was found by multiplying the two side lengths together. Premature rounding lost the accuracy mark in some cases.

Q10. Only a few fully correct answers were seen because reasons, containing all the key elements, were rare. When reasons were given they were seldom all given. If attempted, angles in a triangle add up to 180° and angles on a straight line add up to 180° were generally correct, however 'isosceles triangle equal to 25 since 2 parallel sides' was the most common quote for the rarely mentioned isosceles triangle.
A common method used was to start with the large triangle to give 25+70=95 then 180-95=85 unfortunately they then said *x*=85 so no marks could be awarded.

It was rare to see "angle *ADB*=25" written down but 25 was seen labelled in the diagram and this received 1 mark.

Q11. Many students employed inappropriate methods in their attempts to find the unknown angle *x*. Pythagoras' theorem was often applied to triangle *ADC* or to triangle *ABC* with *AB* taken as 10.4 cm. Some students assumed triangle *ADC* to be isosceles and came close to the correct answer by taking *DC* equal to 10.4 cm. Other incorrect methods involved the incorrect use of the sine or cosine rules again in triangle *ADC*. Those using the sine rule correctly often gave angle *ADC* as an acute angle. This did gain some credit but no marks were awarded for subsequent working which sometimes led to the correct answer by incurring further errors. Students who took the direct route to find angle *ACB* usually gained full marks, however at times premature approximation resulted in the loss of the accuracy mark. Another common successful approach was to find *BC* using Pythagoras' theorem and then use trigonometry to find the required angle.

Q12. This question was well attempted by most candidates but many only achieved M2 for correcting calculating the interior angle of a pentagon as 108°. More candidates chose use the quadrilateral *ABCH* to work out the size of angle *EAH* and they were the most successful. Others used the pentagon *AHCDE* and provided they calculated the reflex angle at *H* correctly usually achieved at least M3. Candidates who chose to use the hexagon *AFGCDE* were the least successful, often failing to realise that the hexagon was not regular. Several weaker candidates assumed the internal angles to be 120° or split the diagram into triangles and labelled their angles 60° assuming them to be equilateral. A common error was to divide 108 by 3 or 72 by 2 which led to the correct answer but was incorrect method so did not achieve full marks.

Q13. Most candidates scored either 1 mark (for *AB* = 5 cm), or full marks for finding the length of *AD* correctly. It was very common to see the sine rule being used in the right angled triangle *ABD*, sometimes involving the right angle and sometimes the 54°. A few candidates used tan and Pythagoras in triangle *ABD*. Providing all the steps involved were logically correct, they were awarded the two method marks. Often this approach led to an answer outside the acceptable range, due to accumulation of rounding errors.

Q14. Many candidates were able to find the 27° size angle – either by using the difference in the interior angles or in the exterior angles. Most candidates seemed to favour the interior angle approach, presumably because the required angle can be directly seen as the difference between the angles in a pentagon and in an octagon. Candidates were asked to supply a reason (or reasons) – this had to refer to the correct formula for the sum of the interior (or internal) angles or its equivalent or to the sum of the exterior angles.

Q15. Part (a) was answered correctly more often than part (b).

The common error in part (a) was to apply Pythagoras' Theorem incorrectly, adding rather than subtracting the squares of the lengths.

In part (b), it was evident that a significant number of candidates were unable to identify angle *RPQ* correctly and, instead, attempted to find angle *RQP*. Candidates at this level are expected to be able to use three-letter notation for angles. The majority of candidates who realised that they had to use cosine in part (b) went on to gain full marks.

Many candidates used Pythagoras' Theorem, finding the missing length and giving this as their answer, clearly not understanding the need to use the trigonometric ratios to find angles. Other candidates did complicate their answer by using Pythagoras' Theorem correctly to find the third side and then used sin or tan correctly; in this case the final accuracy mark was often lost due to premature rounding.