Pearson Edexcel

Mark Scheme

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.

Q1: IAL C12 June 2017 Q12 (a)

Question Number	Scheme	Marks
12(a)	$y = x^3 - 9x^2 + 26x - 18 \Rightarrow \frac{dy}{dx} = 3x^2 - 18x + 26$	M1A1
	At $x = 4 \Rightarrow \frac{dy}{dx} = 3\times4^2 - 18\times4 + 26 (= 2)$	M1
	Equation of normal is $y - 6 = -\frac{1}{2}(x-4) \Rightarrow 2y + x = 16$	dM1A1*
		(5)

(a)

M1 Two of the three terms correct (may be unsimplified).

A1 $\left(\frac{dy}{dx} =\right) 3x^2 - 18x + 26$, need not be simplified. You may not see the $\frac{dy}{dx}$

M1 Substitutes $x = 4$ into their $\frac{dy}{dx}$

dM1 The candidate must have scored both M's. It is for the correct method of finding the equation of a normal. Look for $y - 6 = -\left.\frac{dx}{dy}\right|_{x=4} \times (x-4)$

If the form $y = mx + c$ is used it is for proceding as far as $c = ..$

A1* cso $2y + x = 16$ Note that this is a given answer. $x + 2y = 16$ is ok

Q2: GCE M1 June 2007 7a

Question	Scheme	Marks	AOs
2(a)	(a) $\mathbf{v} = \dfrac{8\mathbf{i}+11\mathbf{j}-(3\mathbf{i}-4\mathbf{j})}{2.5}$ or any equivalent $\mathbf{v} = 2\mathbf{i}+6\mathbf{j}$	M1	1.1b
	Attempts to find an "allowable" angle Eg $tan\theta = \frac{6}{2}$	M1	3.1b
	Bearing = 018°, accept 18.4°	A1	1.1b
		(3)	
(b)	Attempts to find the distance travelled = $\sqrt{(8-3)^2+(11--4)^2} = 5\sqrt{10}$	M1	1.1b
	Attempts to find the speed = $\dfrac{5\sqrt{10}}{2.5}$	dM1	3.1b
	awrt 6.32 only	A1	1.1b
		(3)	
			(6 marks)

Notes

(a)

M1: Attempts velocity

$$\mathbf{v} = \frac{8\mathbf{i}+11\mathbf{j}-(3\mathbf{i}-4\mathbf{j})}{2.5} \text{ or any equivalent}$$

$$\mathbf{v} = 2\mathbf{i}+6\mathbf{j}$$

M1: A full attempt to find the bearing. $arctan\frac{6}{2}, tan\theta = \frac{6}{2}, etc$

A1: Bearing = 018° or 18.4° **only**

(b)

M1: Attempts to find the distance travelled. Allow for $d^2 = (8-3)^2 + (11--4)^2$
There must be some attempt to find the difference between the coordinates.
dM1: Attempts to find the speed. There must have been an attempt to find the distance using the coordinates and then divide it by 2.5. Alternatively, they could find the speed in km min^{-1} and then multiply by 60
A1: awrt 6.32 km h^{-1}, do not accept $2\sqrt{10}$

Q3: IAL C12 June 2016 Q3 (7 marks become 6)

Question Number	Scheme	Marks
3 (i)	Either $4^{2x+1} = 2^{2(2x+1)}$ and $8^{4x} = 2^{3\times 4x}$ or $8^{4x} = 4^{\frac{3}{2}\times 4x}$	M1
	$2(2x+1) = 12x \Rightarrow x = \frac{1}{4}$	dM1A1
		(3)
(ii)(a)	$3\sqrt{18} - \sqrt{32} = 9\sqrt{2} - 4\sqrt{2} = 5\sqrt{2}$	M1A1
		(2)
(b)	$\sqrt{n} = 5\sqrt{2} \Rightarrow n = (5\sqrt{2})^2 = 25\times 2 = 50$	B1 (1)
		(6marks)
Alt 3 (i)	Taking logs of both sides and proceeding to $(2x+1)\log 4 = 4x\log 8$	M1
	$\Rightarrow x = \frac{\log 4}{4\log 8 - 2\log 4}$	
	$\Rightarrow x = \frac{\log 4}{\log 256} = \frac{1}{4}$	dM1A1
		(3)

(i)

M1 Writes both sides as powers of 2 or equivalent Eg $2^{2(2x+1)} = 2^{3\times 4x}$

Alternatively writes both sides as powers of 4 or 8 or 64. Eg $8^{4x} = 4^{\frac{3}{2}\times 4x}$

Note that expressions such as $2^{2+(2x+1)} = 2^{3+4x}$ would be M0

Condone poor (or missing) brackets $2^{2\times 2x+1} = 2^3$ but not incorrect index work eg $4^{2x+1} = 8^{\frac{1}{2}(2x+1)}$

It is possible to use logs. most commonly with base 2 or 4. Using logs it is for reaching a linear form of the equation, again condoning poor bracketing .

$4^{2x+1} = 8^{4x} \Rightarrow \log 4^{2x+1} = \log 8^{4x} \Rightarrow (2x+1)\log 4 = 4x\log 8$

dM1 Dependent upon the previous M. It is for equating the indices and proceeding to $x = ..$

Condone sign/bracketing errors when manipulating the equation but not processing errors

If logs are used they must be evaluated without a calculator. Lengthy decimals would be evidence of this and would be dM0

$(2x+1)\log_2 4 = 4x\log_2 8 \Rightarrow (2x+1)\times 2 = 4x\times 3 \Rightarrow x = ..$

$4^{2x+1} = 8^{4x} \Rightarrow 2x+1 = 4x\log_4 8 \Rightarrow 2x+1 = \frac{3}{2}\times 4x \Rightarrow x = ..$ is fine

A1 $x = \frac{1}{4}$ or equivalent

(ii)(a) Mark part (ii) as one complete question. Marks in (a) can be gained from (b)

M1 Writes either $\sqrt{18} = 3\sqrt{2}$ or $3\sqrt{18} = 9\sqrt{2}$ or $\sqrt{32} = 4\sqrt{2}$

If the candidate writes $3\sqrt{18} - \sqrt{32} = k\sqrt{2}$ it can be scored for $\frac{3\sqrt{18}}{\sqrt{2}} = 9$ or $\frac{\sqrt{32}}{\sqrt{2}} = 4$

A1 $5\sqrt{2}$ or states $k = 5$

The answer without working (the M1) would be 0 marks

(ii)(b)

B1 (n=) 50

Q4: New Spec 9ma0 June 2019 Shadow Papers Q7

Question 7 (Total 7 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$y = C + Kx$, where C and K are constants	B1	This mark is given for stating a correct general equation
(b)	$200 = 650 \times 5 - (C + 650k)$ $-80 = 230 \times 5 - (C + 230k)$	M1	This mark is given for modelling the profit on the two days when pies are sold for £5
	$C + 650K = 3050$ $C + 230K = 1230$	M1	This mark is given for forming a pair of simultaneous equations to find values for C and K
	$420K = 1820 \Rightarrow K = \frac{13}{3}$ $C = 1230 - (230 \times \frac{13}{3}) = \frac{700}{3}$ Thus $y = \frac{13}{3}x + \frac{700}{3}$	A1	This mark is given for finding the values of C and K to find an equation in y
(c)	The gradient represents the cost of making each extra pie in £s	B1	This mark is given for a valid interpretation of the significance of the gradient
(d)	For n pies $5n - (\frac{13}{3}n + \frac{700}{3}) > 0$	M1	This mark is given for a method to find the number of pies to be made
	$\frac{2}{3}n - \frac{700}{3} > 0$ $n > \frac{700}{3} \times \frac{3}{2}$ $n = 350$ pies	A1	This mark is given for correctly finding the number of pies to be made

Q5: New Spec IAL P1 Jan 2019 Q7

Question Number	Scheme	Marks
7.(a)	Attempts $\dfrac{\sin\angle ACB}{6.5}=\dfrac{\sin 35}{4.7}$	M1
	$\angle ACB=\text{awrt}(52\text{ or }53)^\circ$ or $\text{awrt}(127\text{or}128)^\circ$	A1
	$\angle ACB=127.5^\circ$	A1
		(3)
(b)	Eg $\dfrac{(AC)}{\sin"17.5^\circ"}=\dfrac{6.5}{\sin"127.5^\circ"}$ or $=\dfrac{4.7}{\sin 35^\circ}$	M1
	$\left[\dfrac{(CD)}{\sin"75^\circ"}=\dfrac{4.7}{\sin"127.5^\circ"}\Rightarrow(CD)=...\Rightarrow(AC)+(CD)\right]$=awrt 8.2	A1
	Total length of wood $=8.1+6.5+4.7+4.7=\text{awrt}24.1$	A1
		(3)
		(6 marks)
Alt1(a)	$\cos 35=\dfrac{AC^2+6.5^2-4.7^2}{2\times6.5\times AC}\Rightarrow AC^2-13\cos(35)AC+20.16=0\Rightarrow AC=...$	
	$\cos\angle ACB=\dfrac{"AC"^2+4.7^2-6.5^2}{2\times"AC"\times4.7}$ oe	M1

(a)

M1 Uses the sine rule with the angles and sides in the correct positions.

Alternatively they may use the cosine rule on ACB and then solve the subsequent quadratic to find AC and then use the cosine rule again

A1 $\angle ACB=\text{awrt}(52\text{ or }53)^\circ$ or $\text{awrt}(127\text{or}128)^\circ$

A1 $\angle ACB=127.5^\circ$ only

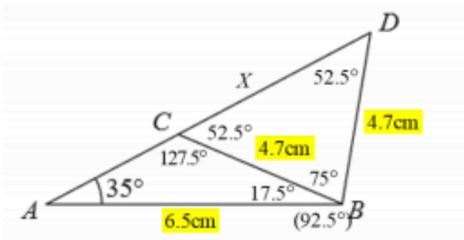
(b) Working for (b) may be found in (a) which is acceptable

M1 Uses a formula that finds **part or all of the length *AD* (eg *AC*, *CD*, *AX*, *XD*, *AD*)**.

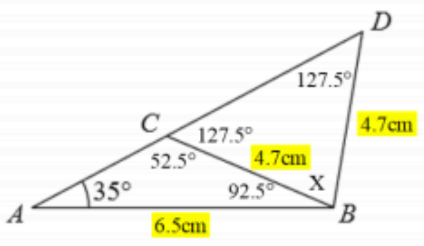
The minimum required for this mark is the use of angle(s) and lengths in the correct places in the formula (which may have been rearranged to an alternative form). Condone mislabelling of the unknown length. This is usually the sine or cosine rule but they could split the triangle into two right angled triangles. See WAYS for additional guidance on methods. Sight of awrt8.2, awrt2.46 or awrt5.72 would imply this mark.

Condone angles in their triangles which do not add up to $180°$ and condone angles found with no working shown. For reference below these are the angles that would be found with $\angle ACB = 127.5°$ and $\angle ACB = 52.5°$ although they may "restart" so check their diagram as this may help.

$\angle ACB = 127.5°$



$\angle ACB = 52.5°$



A1 awrt 8.2 Sight of awrt8.2 implies the length *AD* has been found. Ignore any labelling of lengths in their intermediate working and ignore any reference to *AC* (Accept $"..." = 8.2$). May be implied by a sum that totals awrt8.2 (eg awrt2.46+awrt5.72)

A1 awrt 24.1 ISW. Do not accept 24 or 25 (the length to the nearest metre) without seeing awrt24.1 or a calculation that totals awrt24.1 (eg $4.7 + 4.7 + 6.5 + 8.2\ (= 24.1) \Rightarrow 24$)

Candidates who assumed $\angle ACB = 52.5°$ (acute) in (a):
Full marks can still be achieved as candidates may have restarted in (b) or not used the acute angle in their calculation which is often unclear. We are condoning any reference to $AC = 8.2$ so ignore any labelling of the lengths they are finding.

Q6: IAL C12 June 2015 Q6

Question Number	Scheme	Marks
6.(a)	$(2+ax)^6 = 2^6 + \binom{6}{1}2^5.(ax) + \binom{6}{2}2^4.(ax)^2 + ...$	M1
	$= 64, +192ax + 240a^2x^2 + ...$	B1, A1, A1
		[4]
(b)	$192a = 240a^2$	M1
	$a = \frac{192}{240} = 0.8$ or equivalent	A1
		[2]
		6 marks
Alt 6.(a)	$(2+ax)^6 = 2^6\left(1+\frac{a}{2}x\right)^6 = 2^6\left(1+6\times\frac{a}{2}x+\frac{6\times5}{2}\left(\frac{a}{2}x\right)^2+...\right)$	**M1**
	$= 64, +192ax + 240a^2x^2 + ...$	**B1, A1, A1**
		[4]

(a)

M1 The method mark is awarded for an attempt at a Binomial expansion to get an unsimplified second or third term – Look for a correct binomial coefficient multiplied by a correct power of *x*. Eg ${}^6C_1...x$ or ${}^6C_2..x^2$
Condone bracket errors or errors (or omissions) in the powers of 2.
Accept any notation for ${}^6C_1$, ${}^6C_2$, e.g. as on scheme or 6, and 15 from Pascal's triangle.
This mark may be given if no working is shown, if either or both of the terms including *x* is correct.
If the candidate attempts the expansion in descending powers allow ${}^6C_5...x^5$ or ${}^6C_4..x^4$ oe.

In the alternative it is for the correct form inside the bracket accepting either $1+6\times\frac{a}{2}x+\frac{6\times5}{2}\left(\frac{a}{2}x\right)^2$ or $1+6\times\frac{a}{2}x+\frac{6\times5}{2}\frac{a}{2}x^2$

B1 Must be simplified to 64 (writing just 2^6 is B0).

A1 Score for either of $192a\,x$ or $240a^2x^2$ correct. Allow $240a^2x^2$ appearing as $240(ax)^2$ with the bracket

A1 Score for both of $192a\,x$ and $240a^2x^2$ correct. Allow $240a^2x^2$ appearing as $240(ax)^2$ with the bracket
Allow listing of terms 64, $192ax$, $240a^2x^2$ for all 4 marks.

(b)

M1 Score for setting the coefficients of their x and x^2 terms equal. They must reach an equation not involving x's.
A1 This is cso for any equivalent fraction or decimal to 0.8. Ignore any reference to a =0.

Q7: IAL C12 Jan 2019 Q8

Question Number	Scheme	Marks
8)	$\int\left(2x+\frac{6}{x^2}\right)\mathrm{d}x=\int\left(2x+6x^{-2}\right)\mathrm{d}x=x^2-\frac{6}{x}$	M1A1
	$\left(k^2-\frac{6}{k}\right)-\left(3^2-\frac{6}{3}\right)=10k$	M1
	$\times k\Rightarrow k^3-6-7k=10k^2$	dM1
	$k^3-10k^2-7k-6=0$	A1*
		(5 marks)

M1 Attempts to integrate $2x+\frac{6}{x^2}$ and obtains at least one correct power

A1 $\int\left(2x+\frac{6}{x^2}\right)\mathrm{d}x=x^2-\frac{6}{x}$ which may be left unsimplified

M1 Substitutes in both k and 3 into their integrated expression, attempts to subtract the correct way around and sets equal to $10k$.

Condone a lack of bracketing here. For instance $k^2-\frac{6}{k}-3^2-\frac{6}{3}=10k$ will be common

dM1 Multiplies by k to achieve a cubic equation in k. This must be seen applied correctly at least twice. It is dependent upon both M's as well as achieving *two* correct powers

A1* AG. Achieves $k^3-10k^2-7k-6=0$ with no errors or omissions. For example the bracketing error would mean that this mark is withheld.

Q8: New Spec IAL P1 Oct 2019 Q8

Question Number	Scheme	Marks
8	$x-6x^{\frac{1}{2}}+4=0$	
	$x^{\frac{1}{2}}=3\pm\sqrt{5}$ oe	M1 A1
	$x=\left(3\pm\sqrt{5}\right)^2 \Rightarrow x=14\pm6\sqrt{5}$	M1 A1 A1
		(5 marks)

M1 For attempting to solve an equation of the form $y^2-6y+4=0$ by completing the square or quadratic formula to reach at least one solution. There must be some working shown for this mark to be awarded, accept as a minimum identifying $y=x^{\frac{1}{2}}$ and writing the quadratic in y before solutions.

A1 $\left(x^{\frac{1}{2}}\right)=3\pm\sqrt{5}$ Both required (though one may be later rejected) but need not be simplified, so accept $\dfrac{6\pm2\sqrt{5}}{2}$

M1 For attempting to square a solution of the form $p\pm q\sqrt{r}$ with 2 (out of 4) correct terms (may be implied by correct answers for their terms, but must have seen at least one solution for $x^{\frac{1}{2}}$)

A1 $x=14+6\sqrt{5}$ **or** $x=14-6\sqrt{5}$ as an answer Accept equivalents for this mark.

A1 $x=14+6\sqrt{5}$ **and** $x=14-6\sqrt{5}$ as answers, must be simplified.

Special Case: For candidates who show no initial working and write $x^{\frac{1}{2}}=3\pm\sqrt{5}$ as their first step, M0A0M1A1A1 is possible if they go on to achieve correct answers

Question Number	Scheme	Marks
8 Alt	$x+4=6x^{\frac{1}{2}}$	
	$(x+4)^2=36x$	M1 A1
	$x^2-28x+16=0 \Rightarrow (x-14)^2=180 \Rightarrow x=14\pm\sqrt{180} \Rightarrow x=14\pm6\sqrt{5}$	M1 A1 A1
		(5)

M1 Isolates the square root term and squares both sides.

A1 Correct squared expression, $(x+4)^2$ need not be expanded (as in scheme).

M1 Expands and solves the quadratic in x Note that candidates who square term by term will score no marks.

A1A1 As main scheme. Note for the final A both solutions must be fully simplified.

Q9: New Spec IAL P3 Jan 2020 Q1

Question Number	Scheme	Marks
1 (a)	$P_0 = 300$	B1
		(1)
(b)	$420 = \dfrac{900e^{0.12t}}{2e^{0.12t}+1} \Rightarrow 60e^{0.12t} = 420$	M1 A1
	Correct use of lns $\Rightarrow t = \dfrac{\ln 7}{0.12} = 16.22$	dM1 A1
		(4)
(c)	States that maximum number (upper limit) is 450 so cannot reach 500	B1
		(1)
		6 marks

(a)

B1 300

(b)

M1 Substitutes $N = 420$ and proceeds to $Ae^{0.12t} = B$ condoning slips

A1 $60e^{0.12t} = 420$ oe

dM1 Uses correct ln work to find t. This must be from a solvable equation.

Method 1: $Ae^{0.12t} = B \to e^{0.12t} = k \to 0.12t = \ln k \to t = ...$ $(k > 0)$

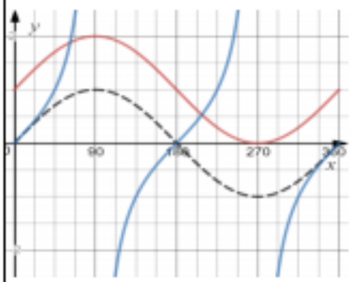
Method 2: $Ae^{0.12t} = B \to \ln A + 0.12t = \ln B \to t = ...$ $(A, B > 0)$

A1 Awrt 16.22 (years)

Note: **Answers without working** (even to accuracy of 1 dp) can score SC 1100.

Eg. $420 = \dfrac{900e^{0.12t}}{2e^{0.12t}+1} \Rightarrow t = 16.2$

Q10: New Spec IAL P1 June 2019 Q9

<table>
<tr><th>Question Number</th><th>Scheme</th><th>Marks</th></tr>
<tr><td>9. (a)</td><td>$(270°, -4)$</td><td>B1 B1
(2)</td></tr>
<tr><td>(b)</td><td>
For $y = 1 + \sin\theta$
$y = \tan\theta$</td><td>B1
B1
(2)</td></tr>
<tr><td>(c)</td><td>(i) $6 \times 2 = 12$
(ii) 11</td><td>M1 A1
B1 ft
(3)
(7 marks)</td></tr>
</table>

(a)

B1 Either coordinate correct. Look for either $270^{(°)}$ or -4 in the correct position within (,).

Alternatively look for either $x = 270$ or $y = -4$ Condone $\frac{3\pi}{2} = 270°$

Do not accept multiple answers unless one point is chosen or it is clearly part of their thought process. There is no need for the degrees symbol. Condone swapped coordinates, ie $(-4, 270)$ for this mark

B1 For correct coordinates.

$(270°, -4)$ with or without degrees symbol. Condone $x = 270(°), y = -4$

(b) These may appear on Figure 3 rather than Diagram 1

B1 For $y = 1 + \sin\theta$ Score for a curve passing through $(0,1), (90°,2), (180°,1), (270°,0), (360°,1)$ with acceptable curvature. Do not accept straight lines

B1 For $y = \tan\theta$ with acceptable curvature. Must go beyond $y = 1$ and -1

Score for the general shape of the curve rather than specific coordinates. See practice and qualification items for clarification.

First quadrant from $(0,0) \to (90°, \infty)$

Second and third quadrants from $(90°, -\infty) \to (270°, \infty)$ passing through $(180°, 0)$

Fourth quadrant from $(270°, -\infty) \to (0,0)$

(c)(i) The question states hence so it is expected the results come from graphs.

If neither or only one graph is drawn then score for 12 in (i) for M1 A1 and 11 in (ii) B1

M1 For the calculation $\frac{2160}{360} = 6$ or $\frac{2160}{180} = 12$ or multiplying the number of intersections in their (b) by 6

Sight of 6 or 12 will imply this mark.

A1 12. 12 will score both marks.

(c) (ii)

B1 ft For either 11 (correct answer)

or follow through on n less than their answer to (c) (i) where n is their number of solutions in the range $180° < \theta \leqslant 360°$

Q11: IAL C12 Jan 2020 Q14

Question Number	Scheme	Marks
14. (a)	$Q=(4,0)$	B1
		(1)
(b)	$\mathrm{f}(x)=(x+2)^2(4-x)=\left(x^2+4x+4\right)(4-x)$	M1
	$=16+12x-x^3$	A1
	Area $=\left[16x+6x^2-\frac{1}{4}x^4\right]_{(-2)}^{(4)}$	dM1 A1 ft
	$=[64+96-64]-[-32+24-4]=108$ CSO	M1 A1
		(6)
(c)	For 486 of ft on 4.5 $\times$their 108	B1 ft
	States 4.5 times bigger	B1
		(2)
		(9 marks)

(a)

B1 $Q=(4,0)$ Accept coordinates written separately or without brackets

Do not accept $(4,0)$ and $(-2,0)$ unless it has been made clear that $Q=(4,0)$

(b)

M1 Attempts to multiply out. This may be seen in part (a)

Look for $\mathrm{f}(x)=(x+2)^2(4-x)=\left(x^2+...+4\right)(4-x)=....$

Or $\mathrm{f}(x)=(x+2)(x+2)(4-x)=(x+2)\left(8.....-x^2\right)=....$

Or if attempted in head $\mathrm{f}(x)=-x^3+........16$

A1 $16+12x-x^3$

dM1 Raises the power by one in at least **two** (different) terms. It is dependent upon the first M1

A1ft Follow through on their cubic.

Do not award this A mark if they adapt their cubic. E.g. $16+12x-x^3 \leftrightarrow x^3-12x-16$

M1 Uses the limits -2 and 4 on a changed function.

Also allow both final marks for $=\left[16x+6x^2-\frac{1}{4}x^4\right]_{-2}^{4}=108$

A1 CSO For reaching 108 and showing all relevant steps (See line above)

(c)

B1ft For 486 or follow through on their answer to $(b)\times 4.5$. **May be awarded without method**

B1 States 4.5 times bigger

Answers with limited or no working.

Case 1: No working

Writes $\int_{-2}^{4}(x+2)^2(4-x)\,dx = 108$ scores no marks

Case 2: Some working

Writes $\int_{-2}^{4}(x+2)^2(4-x)\,dx = \int_{-2}^{4}16+12x-x^2\,dx = 108$ scores M1 A1 dM0 A0 M0 A0

Case 3: Shows all calculus, appreciates the two limits and proceeds to the correct answer which was nc given

$\int_{-2}^{4}(x+2)^2(4-x)\,dx = \int_{-2}^{4}16+12x-x^3\,dx = \left[16x+6x^2-\frac{1}{4}x^4\right]_{-2}^{4} = 108$ scores M1 A1 M1 A1 M1 A1

Q12:
GCE C4 June 2010 Q10 a+b (8 marks become 5)
IAL C12 Oct 2019 Q8a+c (5 marks)

Question Number	Scheme	Marks
10	(a) $(10-2)^2+(7-1)^2$ or $\sqrt{(10-2)^2+(7-1)^2}$	M1
	$(x\pm2)^2+(y\pm1)^2=k$ (k a positive value)	
	$(x-2)^2+(y-1)^2=100$ (Accept 10^2 for 100) (Answer only scores full marks)	A1
	(b) (Gradient of radius =) $\frac{7-1}{10-2}=\frac{6}{8}$ (or equiv.) Must be seen in part (b)	B1
	Gradient of tangent $=\frac{-4}{3}$ (Using perpendicular gradient method)	M1
	$y-7=m(x-10)$ Eqn., in any form, of a line through (10, 7) with any numerical gradient (except 0 or ∞)	
	$y-7=\frac{-4}{3}(x-10)$ or equiv (ft gradient of radius, dep. on both M marks)	
	$\{3y=-4x+61\}$ (N.B. The A1 is only available as ft after B0)	
	The unsimplified version scores the A mark (isw if necessary... subsequent mistakes in simplification are not penalised here. The equation must at some stage be exact, not, e.g. $y=-1.3x+20.3$	A1

8(a)	$(x\pm3)^2+(y\pm7)^2\ ...=...$	Attempts to complete the square. Accept $(x\pm3)^2+(y\pm7)^2\ ...=...$ as evidence. Also score for $(\pm3,\pm7)$	M1
(c)	$k=58$ **or** $k=49$	For $k=58$ or $k=49$. May be implied by their inequalities but do not award for just seeing 49 or 58 as part of a calculation unless it is stated or implied as a value for k.	M1
	$k=58$ **and** $k=49$	Both values obtained with the same conditions as the previous mark.	A1
	One correct "end" e.g. $k>49$, $k<58$, $k\geqslant49$, $k\leqslant58$, [49, …], […, 58] etc.		M1
	Examples: $49<k<58$ $49\leqslant k<58$ $49<k\leqslant58$ $49\leqslant k\leqslant58$ [49, 58], [49, 58), (49, 58], (49, 58) $k>49,\ k<58$ $k>49$ or $k<58$ $k>49$ and $k<58$	Both "ends" correct	A1
			[4]

Q13: OCR Specimen Papers

Answer: a)$\log_{10} y = \log_{10} p + x \log_{10} q$

$m = \log_{10} q$, $c = \log_{10} p$

b)E.g. $\log_{10} q = \frac{2.4-1.6}{1-5} = -0.2$

$q = 10^{-0.2} = 0.63$

$\log_{10} p = 2.5$ so $p = 380$

c)$\log_{10} 20 = 1.3$ so week 7

E.g. Extrapolation is unjustified because it assumes that the assumptions made in the model will hold true in the long term

Q14: New Spec 9ma0 June 2019 Shadow Papers Q10a

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	For even numbers $n = 2m$, $n^2 - 2n + 2 = 4m^2 - 4m + 2$ $= 4(m^2 - m) + 2$	M1	This mark is given for showing the case for all even numbers
	This is a multiple of 4 with 2 added, so cannot be divisible by 4	A1	This mark is given for a correct conclusion with a reason why $n^2 + 2$ is not divisible by 4 for all even numbers
	For odd numbers $n = 2m + 1$, $n^2 - 2n + 2 = (2m + 1)^2 - 2(2m + 1) + 2$ $= 4m^2 + 4m - 4m + 1$ $= 4m^2 + 1$	M1	This mark is given for showing the case for all odd numbers
	This is a multiple of 4 with 1 added, so cannot be divisible by 4 Hence, for all $n \in \mathbb{N}$, $n^2 - 2n + 2$ is not divisible by 4	A1	This mark is given for a correct conclusion with a reason why $n^2 + 2$ is not divisible by 4 for all odd numbers and a full concluding statement that for all $n \in \mathbb{N}$, $n + 2$ is not divisible by 4

Q15: New Spec IAL P1 Jan 2020 Q11

Question Number	Scheme	Marks
11 (a)	Gradient of normal $= \frac{1}{4}$	B1
	Equation of normal $(y+50) = "\frac{1}{4}"(x-4) \Rightarrow y = \frac{1}{4}x - 51$	M1 A1
		(3)
(b)	$(f''(x) =)\ \frac{6}{\sqrt{x^3}} + x = 6x^{-\frac{3}{2}} + x \Rightarrow f'(x) = -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 + k$	M1 A1
	Substitutes $x = 4,\ f'(x) = -4 \Rightarrow k = -6$	dM1 A1
	$(f'(x) =)\ -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 - 6 \Rightarrow (f(x) =)\ -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + d$	dM1 A1ft
	Substitutes $x = 4,\ f(x) = -50 \Rightarrow d = \frac{34}{3}$	dddM1
	$(f(x) =) -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + \frac{34}{3}$	A1
		(8) (11 marks)

Mark (a) and (b) together

(a)

B1 Deduces that the gradient of the normal is $\frac{1}{4}$

M1 Attempts to find the equation of a line passing through $P(4,-50)$ with a **changed** gradient. Allow one sign slip on a coordinate so either $(y+50)$ or $(x-4)$ must be correct. If they use $y = mx + c$ then at least one of the coordinates must be correctly substituted in and they must proceed as far as $c = ...$

A1 $y = \frac{1}{4}x - 51$

(b)

M1 Attempts to integrate $\frac{6}{\sqrt{x^3}} + x$ with one index correct. Either $...x^{-\frac{1}{2}}$ or $...x^2$

A1 $(f'(x)) = -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 + k$ (unsimplified) with or without the $+k$

dM1 Substitutes $x = 4,\ f'(x) = -4$ into an integrated form (with $+k$) and proceeds to find the value of k
This is dependent on the first M1.

A1 $(f'(x)=) -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 - 6$ (unsimplified) which may be implied

dM1 Dependent upon the first M. It is for integrating 'again' with one index correct. Either $...x^{\frac{1}{2}}$ or $...x^3$

A1ft $(f(x)=) -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + d$ (unsimplified) following through ONLY on their k (allow kx) and with or without d

dddM1 Dependent upon all three previous Ms.
Both "k" and "d" must have been added although condone calling them both c.
This mark is scored for using $x = 4,\ f(x) = -50$ in an attempt to find 'd'. Do not be concerned by the mechanics of their rearrangement.

A1 $(f(x) =)\ -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + \frac{34}{3}$ or **exact equivalent expressions**. Eg Do not allow $\frac{1}{6}$ to be written as 0.167 but condone $-6x^1$. The indices must have been processed and the terms must all be on one line including $\frac{34}{3}$. isw after a correct expression.