

Please note: Assignment of marks to the answers in all the following examples is for demonstration purposes only. Marks for actual examination questions will not necessarily follow the same pattern.

Implementation:

Question: Factorise $x^2 - 5x - 6$

Markscheme	Candidates' Scripts	Marking
$(x-6)(x+1)$ (A1)(A1)	(i) Answer line: $(x-6)(x+1)$	(C2)
	(ii) Answer line: $(x+6)(x+1)$	(A0)(A1)
	(iii) Working box: $(x-6)(x+1)$ followed by answer line: $x = 6$ and -1 , or just $6, -1$	(A1) (A0)
	(iv) Working box: $(x-6)(x+1)$ then $x = 6, -1$ followed by answer line: $x = 6$ and -1 , or just $6, -1$ or factors and roots together	(A1) (A0)
	but	
	(v) Working box: $(x-6)(x+1)$ then $x = 6, -1$ followed by answer line: $(x-6)(x+1)$ only	(C2)
	(vi) Working box: $(x-6)(x+1)$ then $x = 6, -1$ and answer line empty	(A1)(A0)

Question: Using Pythagoras to find a side of a triangle:

Markscheme	Candidates' Scripts	Marking
$\sqrt{9+4} = \sqrt{13}$ (M1)(A1) (3.61 3sf)	(i) Answer line: $\sqrt{13}$ or 3.61 or both	(C2)
	(ii) Working box: $\sqrt{9+4} = \sqrt{13} = 6.50$ Answer line 6.5	(M1) (A0)
	(iii) Working box: $\sqrt{9+4} = \sqrt{13} = 6.50$ Answer line empty	(M1)(A0)
	(iv) Working box: $\sqrt{9+4} = \sqrt{13} = 3.61$ but answer line 3.16	(M1)(A1)
	For further considerations on this problem with regard to accuracy see later examples.	<i>(obvious transcription error)</i>

Question: Calculate the gradient of the line passing through the points (5,3) and (0,9).

Markscheme	Candidates' Scripts	Marking
$\frac{9-3}{0-5} = -\frac{6}{5} \quad (M1)(A1)$	(i) Working: $m = \frac{9-3}{0-5} = -\frac{6}{5}$ followed by $y = -6x/5 + 9$ but $-6/5$ on answer line (ii) Working box: $m = \frac{9-3}{0-5} = -\frac{6}{5}$ followed by $y = -6x/5 + 9$ and then answer line: either $y = -6x/5 + 9$ or $y = -6x/5$ or nothing at all on the answer line	(C2) (M1) (A0) (even if $-6/5$ is also on the answer line)

3 Follow through (ft) Marks

Errors made at any step of a solution can affect all working that follows. To limit the severity of the penalty, **follow through (ft)** marks can be awarded. Markschemes will indicate where it is appropriate to apply follow through in a question with '**(ft)**' appended to the eligible mark(s).

- If an answer resulting from follow through is extremely unrealistic (e.g. negative distances or wrong by large order of magnitude) then the final **A** mark should not be awarded. If in doubt, contact your team leader.
- If a question is transformed by an error into a **different, much simpler question** then follow through might not apply or might be reduced. In this situation consult your team leader and record the decision on the candidate's script.
- To award follow through marks for a question part, **there must be working present for that part** and not just an answer based on the follow through. An isolated follow through answer, with no working, must be regarded as incorrect and receives no marks **even if it seems approximately correct**.
- Inadvertent use of radians will be penalised the first time it occurs. Subsequent use, even in later questions, will normally be allowed follow through marks, unless the answer is unrealistic. Cases of this kind will be addressed on an individual basis.

Implementation: The following examples illustrate correct use of the **follow through** process in straightforward situations.

Question: An investment problem with two different rates of interest and a total amount of \$600 split across the rates in consecutive periods:

Markscheme	Candidate's Script	Marking
(a) $\\$ 600 \times 1.02$ (M1) $= \\$ 612$ (A1) (b) $\\$ \left(\frac{612}{2} \times 1.02 \right) + \left(\frac{612}{2} \times 1.04 \right)$ (M1) $= \\$ 630.36$ (A1)(ft) Note: The (M1) is for splitting the value from (a) and forming a sum of products. Here the (ft) indicates a possible follow through from part (a).	Case (i) (a) Final amount after 1st period $= \\$ 600 \times 1.02$ $= \\$ 602$ (M1) (A0) (b) Amount after 2nd period $= 301 \times 1.02 + 301 \times 1.04$ $= \\$ 620.06$ (M1) (A1)(ft) but note Case (ii) an (M0) almost always prohibits the associated (ft) so (a) $\\$ 600 \times 1.02 = \\$ 602$ (M1)(A0) (b) $\\$ 602 \times 1.04 = \\$ 626.08$ (M0)(A0)(ft) Case (iii) (a) $\\$ 600 \times 1.02 = \\$ 602$ (M1)(A0) (b) No working. 620.06 on answer line. (M0)(A0)(ft)	

Question: Finding angles and lengths using trigonometry

Markscheme	Candidate's Script	Marking
(a) $\frac{\sin A}{3} = \frac{\sin 30}{4}$ (M1)(A1) $A = 22.0^\circ$ (A1) (b) $x = 7 \tan A$ (M1) $= 2.83$ (A1)(ft)	(a) $\frac{\sin A}{4} = \frac{\sin 30}{3}$ $A = 41.8^\circ$ (b) case (i) $x = 7 \tan A$ $= 6.26$ but case (ii) 6.26	(M1) (A0) (use of sine rule but with wrong values) (A0) (Note: the 2nd (A1) here was not marked (ft) and cannot be awarded because there was an earlier error in the same question part.) (M1) (A1)(ft) (C0)(ft)

4 Using the Markscheme

This markscheme presents a particular way in which each question might be worked and how it should be marked.

- (a) As **A** marks are normally **dependent** on the preceding **M** mark being awarded, it is **not** possible to award **(M0)(A1)**. Once an **(M0)** has been awarded, all subsequent **A** marks are lost in that part of the question, even if calculations are performed correctly, until the next **M** mark, unless otherwise instructed in the markscheme. (See the first example above). Similarly **(A1)(R0)** cannot be awarded for an answer which is accidentally correct for the wrong reasons given.

Implementation: Question: (a) χ^2 calculated followed by (b) degrees of freedom found and (c) and (d) comparison to critical value. (Interdependence of **A** and **R** marks.)

Markscheme	Candidate's Script	Marking
(a) $\chi_{calc_2} = 3.92$ (A1)	Case (i) (a) $\chi_{calc_2} = 3.92$	(A1)
(b) $n = 4$ (A1)	(b) $n = 4$	(A1)
(c) $\chi_{crit_2} = 9.488$ (A1)(ft)	(c) Don't know?	(A0)
(d) Do not reject null hypothesis (A1)(ft) because $\chi_{calc}^2 < \chi_{crit}^2$ (R1)(ft)	(d) Do not reject null hypothesis	(A0)
	because $\chi_{calc}^2 > 0$ (R0)	
	Case (ii) (a) $\chi_{calc_2} = 3.92$	(A1)
	(b) $n = 4$	(A1)
	(c) $\chi_{crit_2} = 4.488$	(A0)
	(d) Do not reject null hypothesis (A1)(ft) because $\chi_{calc}^2 < \chi_{crit}^2$ (R1)(ft)	
	Case (iii) (a) $\chi_{calc_2} = 3.92$	(A1)
	(b) $n = 1$	(A0)
	(c) $\chi_{crit_2} = 3.841$	(A1)(ft)
	(d) Reject null hypothesis (A1)(ft) because $\chi_{calc_2} > \chi_{crit}^2$ (R1)(ft)	

- (b) **Alternative methods** have not always been included. Thus, if an answer is wrong then the working must be carefully analysed in order that marks are awarded for a different method in a manner that is consistent with the markscheme.
- Where alternative methods for complete questions are included in the markscheme, they are indicated by „**OR**’ etc. This includes alternatives obtained with a graphic display calculator.

Example: Question to find the coordinates of a vertex of a given quadratic

Working	Marks
$f(x) = 2x^2 + 7x - 3$ $x = -\frac{b}{2a} = -\frac{7}{4}$ (M1) for use of $-b/2a$, (A1) for correct answer $f(-\frac{7}{4}) = -\frac{146}{16} = -\frac{73}{8}$ (M1) for using $f(-7/4)$, (A1) for answer. Coordinates are $(-7/4, -73/8)$	 (M1)(A1) (M1)(A1)(ft) (A1)(ft)
OR $f'(x) = 4x + 7$, $4x + 7 = 0$ so $x = -7/4$ (M1) for attempting to take a derivative and setting it to 0 (A1) for answer $f(-\frac{7}{4}) = -\frac{146}{16} = -\frac{73}{8}$ (M1) for using $f(-7/4)$, (A1) for answer. Coordinates are $(-7/4, -73/8)$	 OR (M1) (A1) (M1)(A1)(ft) (A1)(ft)

- (c) Unless the question specifies otherwise, accept **equivalent forms**. For example: $\frac{\sin \theta}{\cos \theta}$ for $\tan \theta$.
 On the markscheme, these equivalent numerical or algebraic forms will sometimes be written in brackets after the required answer.
- (d) As this is an international examination, all valid **alternative forms of notation** should be accepted. Some examples of these are:
- Decimal points: 1.7; 1'7; 1·7; 1,7 .
- Different descriptions of an interval: $3 < x < 5$; (3, 5);] 3, 5 [.
- Different forms of notation for set properties (e.g. complement): A' ; $\bar{A}$; A^c ; $U - A$; $(A \cup A)$.
- Different forms of logic notation: $\neg p$; p' ; $\tilde{p}$; $\bar{p}$; $\sim p$.
 $p \Rightarrow q$; $p \rightarrow q$; $q \Leftarrow p$.
- (e) Discretionary **(d)** marks: There will be rare occasions where the markscheme does not cover the work seen. In such cases, **(d)** should be used to indicate where an examiner has used discretion. It must be accompanied by a brief note to explain the decision made.

5 Accuracy of Answers

Unless otherwise stated in the question, all numerical answers must be given exactly or correct to 3 significant figures.

A penalty known as an **ACCURACY PENALTY (AP)** is applied if an answer is either

- (i) rounded **incorrectly** to 3 significant figures or
- (ii) rounded **correctly** or **incorrectly** to some other level of accuracy.

This penalty is applied to the **final answer** of a question part only. It applies **also** when an exact answer is **incorrectly rounded**.

THE ACCURACY PENALTY IS APPLIED AT MOST ONCE PER PAPER! Subsequent accuracy errors can be **ignored** and full marks awarded if all else is correct.

An accuracy penalty must be recorded in proximity to the **incorrect** answer as **(A0)(AP)**.

Examiners must record the occurrence of an accuracy penalty by writing **(AP)** next to the relevant question total on the front of the cover sheet.

If the level of accuracy is specified in the question, a mark will be allocated for giving the answer to the required accuracy. In **all** such cases the final mark is not awarded if the rounding does not follow the instructions given in the question. This is **NOT** an accuracy penalty. A mark for specified accuracy can be regarded as a **(ft)** mark regardless of an immediately preceding **(M0)**.

Rounding of an exact answer to 3 significant figures **should be accepted if performed correctly**. If the rounding is **incorrect**, an accuracy penalty should be applied as detailed above. Exact answers such as $\frac{1}{4}$ can be written as decimals to less than three significant figures if the result is still exact. Reduction of a fraction to its lowest terms is **not** essential.

Ratios of π and answers taking the form of square roots of integers (**even if exact squares**) or any rational power of an integer (*e.g.* $\sqrt{13}$, $2^{\frac{2}{3}}$, $\sqrt[4]{5}$, $\sqrt{9}$) may be accepted as exact answers. All other powers (*e.g.* of non-integers) and values of transcendental functions such as sine and cosine must be evaluated. Answers **with no supporting working** (usually from a GDC), which are written correct to more than 3 significant figures can be awarded full marks with an **(AP)** then applied. When this happens, multiple C marks can be split (*e.g.* **(A1)(A0)(AP)** or **(C1)(C0)(AP)**).

If there is no working shown, and answers are given to the correct two significant figures, apply the **(AP)**. However, do not accept answers to one significant figure without working.

An accuracy penalty should not be applied to an answer that is already **incorrect** for some other reason.

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