# AQA Style Pre Paper 3H Practice Paper June 2018 Answers

This set of answers is not a conventional marking scheme; while it gives a basic allocation of marks, its main purpose it to help students understand how to do each question and how they can avoid making mistakes.  As such, its format is rather different from that of a normal mark scheme. Included with each answer is the statement from the specification to which it applies (where “basic foundation content” is in normal type, “additional foundation content” is in <u>underlined type</u>, and “higher content” is in **bold type**); content in *italics* is taken from the ‘notes’ sections of the specification.  **All** content can be assessed on Higher tier question papers.

The following guidance is adapted from that issued by AQA

**Types of mark**

**M** Method marks are awarded for a correct method which could lead to a correct answer.

**A** Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.

**B** Marks awarded independent of method.

**Working out**

Usually, if the question asks students to show working, marks are not awarded to students who show no working.  As a general principle, where the questions does not ask students to show working, a correct answer is awarded full marks.  However, if the answer is incorrect, students can still obtain method marks, assuming that they show some valid working out.  **An incorrect answer with no working out is always awarded zero.**

**Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer.  This is normally penalised by 1 mark.

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 1 | **G3** understand and use alternate and corresponding angles on parallel lines; *colloquial terms such as Z angles are not acceptable and should not be used* | | |
| | corresponding | B1 | |
| 2 | **N5** apply systematic listing strategies **including use of the product rule for counting** | | |
| | 120 | B1 | 1 × 2 × 3 × 4 × 5 |
| 3 | **G5** use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) | | |
| | "Triangles $A$, $B$ and $C$ are all congruent." | B1 | |
| 4 | **N7** calculate with roots, and with integer indices<br>**N9** calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and $n$ is an integer | | |
| | $2 \times 10^k$ | B1 | |
| 5 | **R6** apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) *including better value or best-buy problems* | | |
| | **R11** use compound units such as speed, rates of pay, unit pricing *including making comparisons* | | |
| | Multibuy is £7.98 for 1500g | M1 | May be implied. May state that multibuy is better value than the single standard box without further working. |
| | **Either** 4.49 ÷ 0.85 = 5.28…<br>and 7.98 ÷ 1.5 = 5.32…<br>**or** 850 ÷ 4.49 = 189.30…<br>1500 ÷ 7.98 = 187.97…<br>**(other variants possible)** | M1 | **Either** divide the price by the quantity (to find the cost of 1 kg or 1 g) **or** divide the quantity by the price (to find the quantity per £1 or 1p). There are several alternatives (g or kg, £1 or 1p); two are given here. |
| | | A1 | Both divisions must be correct for the second mark. |
| | Economy | B1 | As well as ticking the box, write down your conclusion from the calculations. Of course, ticking a box (even the correct one) with no working out will get you no marks. |
| 6 | **A6** know the difference between an equation and an identity | | |
| | **Either** $a - 1 = 3$ (using $x$)<br>**or** $2a = 8$ (using constant) | M1 | |
| | 4 | A1 | |
| 7 | **A4 simplify and manipulate algebraic expressions (including those involving surds and algebraic fractions) by expanding products of two or more binomials** | | |
| | $(2x^2 + x - 21)(x + 2)$<br>**or** $(2x + 7)(x^2 - x - 6)$ | M1 | These are two likely methods, but any valid method to expand the three brackets would be awarded **M1.**<br>You would be allowed a couple of minor errors if your main method was good (any errors would be likely to cost you at least one of the **A** marks later). |
| | $2x^3 + 5x^2 - 19x - 42$ | A2 | **A2** if all four terms are correct; **A1** if three of the four terms are correct. |

| Q | Answer | Mark | Comments |
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| 8 | **R5** divide a given quantity into two parts in a given part : part or part : whole ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) | | |
| | **Either** 3 tonnes = 3000 kg<br>**or** 800 kg = 0.8 tonnes and 2100 kg = 2.1 tonnes | M1 | |
| | **Either** 3000 ÷ 4 = 750 and 2100 ÷ 3 = 700<br>**or** 3 ÷ 4 = 0.75 and 2.1 ÷ 3 = 0.7 | M1 | This identifies the quantity of sand as the "limiting" ingredient; there will be some cement and some gravel left over when the cement has been made. |
| | **Either** (1 + 4 + 3) × 700 kg<br>**or** (1 + 4 + 3) × 0.7 tonnes | M1 | Units not essential here |
| | 5600 kg **or** 5.6 tonnes | A1 | Units must now be correct |
| 9 | **S4** interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers) | | |
| | Mid values seen | B1 | Use the middle of each interval. Should be 232.5, 237.5, 242.5 and 247.5. |
| | 5 × 232.5 + 18 × 237.5 + 14 × 242.5 + 3 × 247.5 (= 9575) | M1 | If your method is right, you will be let off a small mistake here. |
| | "your 9575" ÷ 40 (= 239.375) | M1 | Whatever you get for the total height must be divided by the number of basketball players. |
| | 239.4 cm or 2394 mm | A1 | Units must be present |
| 10 (a) | **R9** express one quantity as a percentage of another | | |
| | Correct method to find percentage in Scotland. | M1 | $\frac{5.8}{64.9} \times 100$ |
| | 8.9% | A1 | |
| 10 (b) | **R9** work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics | | |
| | Equates 131% to 53.0. | M1 | |
| | 40.5 million | A1 | Any method in which 31% of 53.0 million is found must be **M0 A0**. |
| 11 | **A17** solve linear equations in one unknown algebraically <u>including those with the unknown on both sides of the equation</u> | | |
| | Attempts to put terms in $x$ together | M1 | Should see at least $\frac{x}{2} - \frac{x}{3}$ (may be reversed, for example if rearrangement puts $x$ on right hand side). |
| | Sees $\frac{x}{6} = -1\frac{2}{3}$ or $\frac{x}{6} = -\frac{5}{3}$ | M1 | or equivalent. |
| | −10 | A1 | |

| Q | Answer | Mark | Comments |
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| 12 | **A5** rearrange formulae to change the subject | | |
| | $z(w + 7) = w - 4$ | M1 | Multiplies to eliminate fraction |
| | $w(z - 1) = -4 - 7z$ | M1 | Terms in $z$ separated and factorised |
| | $w = \dfrac{-4 - 7z}{z - 1}$ | A1 | Must see "$w =$". Even better would be $w = \dfrac{4 + 7z}{1 - z}$ if you were to do the rearrangement in a slightly different way. |

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| 13 | **G17** surface area and volume of spheres, pyramids, cones and composite solids | | |
| | **G10 apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results** | | |
| | **G20** know the formula for Pythagoras' theorem, $a^2 + b^2 = c^2$ and apply to find angles and lengths in right-angled triangles in two dimensional figures | | |
| | Angle *PQR* is 90° | B1 | Circle theorem; angle in semicircle is 90° |
| | Uses Pythagoras to find length of *PR* | M1 | $PR^2 = 4.5^2 + 2.8^2$; $PR = 5.3$ cm |
| | Finds area of circle using $\pi \times \text{radius}^2$ | M1 | $\pi \times 2.65^2$<br>Must see radius = 2.65 cm used. |
| | 22.1 (22.0618…) | A1 | |

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| 14 | **A6** argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments **to include proofs** | | |
| | $(n + 1)^2 - n^2$<br>**or** $n^2 - (n - 1)^2$ | M1 | Allow errors (for example missing brackets) for **M1**. Need to see attempt to subtract expressions for two consecutive integers, each of which is squared. We chose $n$ here …other letters are available. |
| | **Either** $(n + 1)^2 - n^2$<br>$= n^2 + 2n + 1 - n^2$<br>**or** $n^2 - (n - 1)^2$<br>$= n^2 - n^2 + 2n - 1$ | M1 | Bracket correctly expanded and correct subtraction (may still be unsimplified) obtained. |
| | Clear conclusion from $2n + 1$ or $2n - 1$ | B1 | Must follow completely correct working; must see argument based on $n + (n + 1) = 2n + 1$ or $(n - 1) + n = 2n - 1$ |

| Q | Answer | Mark | Comments |
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| **15** | **A9** find the equation of the line through two given points, or through one point with a given gradient; **use the form $y = mx + c$ to identify perpendicular lines** | | |
| | Gradient of $PQ$ is $-\frac{3}{2}$ **or** $-1\frac{1}{2}$. | M1 | |
| | Gradient of perpendicular is $\frac{-1}{\text{your gradient of } PQ}$ | M1 | |
| | $y = \frac{2}{3}x - 1$ **or** $3y = 2x - 3$ **or** $3y - 2x + 3 = 0$ | M1 | $y = mx + c$ (where m is $\frac{-1}{\text{your gradient of } PQ}$, c is any negative number) **M1**<br>$y = mx - 1$ (where m is any positive number) **M1**<br>$y = \frac{2}{3}x + c$ (where c is any positive number) **M1** |
| | | A1 | Correct answer. |

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| **16** | **A18** solve quadratic equations algebraically **by completing the square and by using the quadratic formula** | | |
| | $\frac{-6 \pm \sqrt{36 - 4 \times 1 \times (-5)}}{2 \times 1}$ | M1 | Correct attempt to use quadratic formula; must see −6 at start, and positive value inside the square root |
| | **or** attempt at use of completed square form (must see **either** $(x + 3)^2$, **or** any expression of the form $(x - p)^2 - q$ for which the constant simplifies to −14) | | **or**, if completing the square chosen, must see $x$ − "your 3" = ± square root of "your 14" (if 14 is not correct, must be a positive number).<br>Note that the ± (or similar) is required. |
| | −6.74 | A1 | If only one correct answer is present, without correct working, award **M0 A1 A0**. |
| | 0.74 | A1 | |

| Q | Answer | Mark | Comments |
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| Q | Answer | Mark | Comments |
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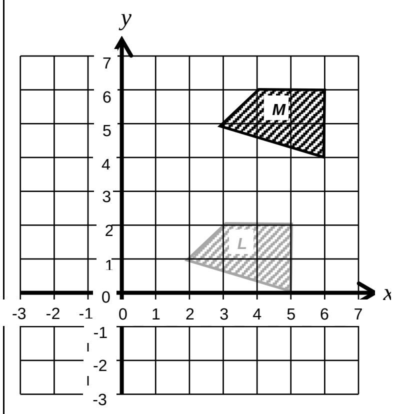
| **17 (a)** | **G7** identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement *including using column vector notation for translations* | | |
| |  | B1 | Any translation of *L* |
| | | B1 | Shape *M*; check all vertices correct. |

| Q | Answer | Mark | Comments |
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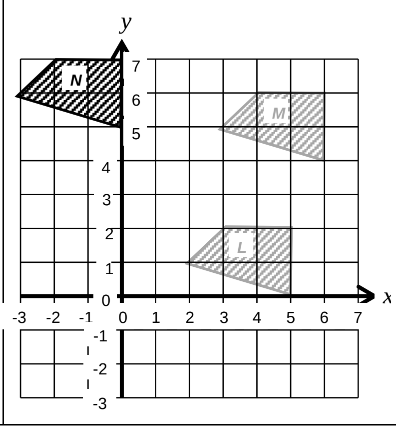
| **17 (b)** | **G8 describe the changes and invariance achieved by combinations of rotations, reflections and translations *including using column vector notation for translations*** | | |
| |  | B1 | Shape *M* (may be incorrect) correctly translated $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$. |
| | | B1 | Shape *N* correctly translated from correct *M*; check all vertices correct. |

| Q | Answer | Mark | Comments |
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| **17 (c)** | **G8 describe the changes and invariance achieved by combinations of rotations, reflections and translations *including using column vector notation for translations*** | | |
| | Translation | B1 | |
| | using vector $\begin{pmatrix} -5 \\ 5 \end{pmatrix}$ | B1 | Must use correct vector notation (do not use statements like “5 left, 5 up”, etc). |

| Q | Answer | Mark | Comments |
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| Q | Answer | Mark | Comments |
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| 18 (a) | **A20 find approximate solutions to equations numerically using iteration, *including the use of suffix notation in recursive formulae*** | | |
| | $x = 3$ and $x = 4$ both substituted into $x^2 + \frac{10}{x}$ | M1 | $3^2 + \frac{10}{3} = 12.333…$ or $12\frac{1}{3}$ and $4^2 + \frac{10}{4} = 18.5$ or $18\frac{1}{2}$<br>If intention is clear, values need not be correct for **M1**. |
| | Clear and correct reason | B1 | Because $3^2 + \frac{10}{3} < 16 < 4^2 + \frac{10}{4}$ , solution must lie between $x = 3$ and $x = 4$. Both values must be correct. |

| Q | Answer | Mark | Comments |
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| 18 (b) | **A20 find approximate solutions to equations numerically using iteration, *including the use of suffix notation in recursive formulae*** | | |
| | **Alternative method 1** $x_1 = 3$ | | |
| | $x_2 = 3.3619…$ | M1 | 3 substituted to obtain first iterate. |
| | $x_3 = 3.5247…$<br>$x_4 = 3.5933…$<br>$x_5 = 3.6213…$<br>($x_6 = 3.6327…$)<br>($x_7 = 3.6373…$) | M1 | Obtains correct values for $x_4$ and $x_5$ and makes clear that, being equal to two decimal places, first decimal place will remain unchanged. |
| | 3.6 | A1 | Must be correctly rounded |
| | **Alternative method 2** $x_1 = 4$ | | |
| | $x_2 = 3.7797…$ | M1 | 4 substituted to obtain first iterate. |
| | $x_3 = 3.6956…$<br>$x_4 = 3.6625…$<br>$x_5 = 3.6493…$<br>$x_6 = 3.6440…$<br>($x_7 = 3.6419…$)<br>($x_8 = 3.6410…$) | M1 | Obtains correct values for $x_5$ and $x_6$ and makes clear that, being equal to two decimal places, first decimal place will remain unchanged. |
| | 3.6 | A1 | Must be correctly rounded |

| Q | Answer | Mark | Comments |
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| **19 (a)** | **A22** solve linear inequalities in one variable; *students should know the conventions of an open circle on a number line for a strict inequality and a closed circle for an included boundary.* | | |
| | $-2 < x \le 3$ | M1 | Note the link between the different circles and the symbols < and ≤. |
| **19 (b)** | **A22 solve linear inequalities in one or two variable(s);** ***in graphical work the convention of a dashed line for a strict inequality and a solid line for an included inequality will be required*** | | |
| | $x + y < 2$<br>$2y \geq x - 4$ | B1 | Note the use of dashed and solid lines |
| **19 (c)** | **A22 solve quadratic inequalities in one variable** | | |
| | $(x + 5)(x - 6) > 0$ | M1 | |
| | $x > 6$ or $6 < x$ | A1 | Both must appear as separate inequalities. Do not allow any marks for $-5 > x > 6$ (note that $-5 > 6$ is false). Special case marks; $-5 < x < 6$ **A1 A0**; any (otherwise correct) substitution of ≥ for > or ≤ for <, allow **A1 A0**. |
| | $x < -5$ or $-5 > x$ | A1 | |
| **20** | **G10 apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results** | | |
| | *GFD* | B1 | |

| Q | Answer | Mark | Comments |
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| 21 (a) | **S3 construct and interpret diagrams for grouped discrete data and continuous data, ie histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use** | | |
| | **Both of**<br>“70 insects had a lifespan of less than 10 days”<br>“Twice as many insects had a lifespan of between 10 and 15 days as had a lifespan of between 15 and 20 days”<br>**ticked**<br><br>**both of**<br>“28 insects had a lifespan of between 10 and 15 days”<br>“Twice as many insects had a lifespan of between 15 and 20 days as had a lifespan of less than 10 days”<br>**left blank** | B1 | Would accept any clear indication (eg T or F for true and false, etc) - but why not just tick the two boxes, like you were told to? |

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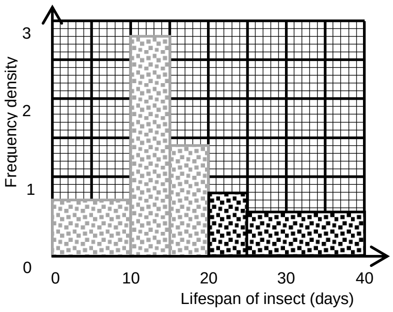
| 21 (b) | **S3 construct and interpret diagrams for grouped discrete data and continuous data, ie histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use** | | |
| |  | M1 | Either “280 insects less than 20 days” or “120 insects over 20 days” seen |
| | | A1 | Correct bar for 40 insects between 20 and 25 days (frequency density = 8) |
| | | A1 | Correct bar for 80 insects over 25 days (frequency density = 5.33… or $5\frac{1}{3}$ ) |

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| 22 | **G23 know and apply Area = $\frac{1}{2}ab\sin C$ to calculate the area, sides or angles of any triangle** | | |
| | Uses area of triangle = $\frac{1}{2}ab\sin C$ | M1 | Look for 20 = $\frac{1}{2} \times 6 \times 8 \times \sin(180° - x)$ or<br>20 = $\frac{1}{2} \times 6 \times 8 \times$ sin(included angle)<br>for **M1** allow minor errors (for example 40 = …, or sin$x$)<br>Must see some attempt at substitution (not just statement of area = $\frac{1}{2}ab\sin C$ formula). |
| | sin(included angle) = $\dfrac{20}{\frac{1}{2} \times 6 \times 8}$ | M1 | Completely correct |
| | Included angle = 56.4426… | A1 | If 20 = $\frac{1}{2} \times 6 \times 8 \times \sin(180° - x)$ used previously, may not need to see the 56.4426… |
| | $x$ = 123.6° | A1 | |

| Q | Answer | Mark | Comments |
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| 23 | **A12** recognise, sketch and interpret graphs of linear functions and quadratic functions **including exponential functions $y = k^x$ for positive values of $k$** | | |
| | $a \times b^0 = 2$ **or** $a \times 1 = 2$ | M1 | |
| | "your 2" × $b^2 = 18$ **or** $b^2 = 9$ | M1 | Allow attempt at a correct method here if $a$ is incorrect |
| | $2 \times 3^4$ | M1 | Substitute $x = 4$ into "your $y = 2 \times 3^x$" |
| | 162 | A1 | |

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| 24 (a) | **G25 use vectors to construct geometric arguments and proofs** | | |
| | Any valid method | M1 | At least one of $\frac{1}{2}\mathbf{a}$ or $\frac{1}{2}\mathbf{b}$ seen. |
| | $\frac{1}{2}\mathbf{a} - \frac{1}{2}\mathbf{b}$, or $\frac{1}{2}(\mathbf{a} - \mathbf{b})$ | A1 | |

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| 24 (b) | **R12** compare lengths, areas and volumes using ratio notation, scale factors; make links to similarity (including trigonometric ratios) | | |
| | Any valid method | B1 | For example similar triangles $AMQ$ and $NRQ$, to give $QM = 2RQ$ and $RQ = \frac{1}{3}RM$ |
| | | B1 | $\overrightarrow{OQ} = \overrightarrow{OR} + \overrightarrow{RQ} = \frac{1}{2}\overrightarrow{OM} + \frac{1}{3} \times \frac{1}{2}\overrightarrow{OM} = \frac{2}{3}\overrightarrow{OM}$ |

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| 24 (c) | **G25 use vectors to construct geometric arguments and proofs** | | |
| | **Either** $\overrightarrow{QM} = \frac{1}{6}\mathbf{a} + \frac{1}{6}\mathbf{b}$ **or** $\overrightarrow{OQ} = \frac{1}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$ | M1 | |
| | $\overrightarrow{QA} = \overrightarrow{QO} + \overrightarrow{OA}$ or $\overrightarrow{QA} = \overrightarrow{QM} + \overrightarrow{MA}$ | M1 | |
| | $\frac{2}{3}\mathbf{a} - \frac{1}{3}\mathbf{b}$ or $\frac{1}{3}(2\mathbf{a} - \mathbf{b})$ | A1 | |