

Q1. (2019)

(A)

|                                                               |                                                                                                                                                          |       |                                                                                        |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------|
| 20(a)                                                         | <b>Alternative method 1: shows that <math>\angle BAC = \angle ACD</math> and alternate angles</b>                                                        |       |                                                                                        |
|                                                               | $\angle ACD = \angle ABC$                                                                                                                                | M1    | accept both with same letter on diagram                                                |
|                                                               | $\angle ABC = \angle BAC$                                                                                                                                | M1    | accept both with same letter on diagram                                                |
|                                                               | $\angle BAC = \angle ACD$<br>and alternate segment (theorem)<br>with M2 awarded                                                                          | M1dep | dep on M2                                                                              |
|                                                               | Other two correct reasons given<br>with M3 awarded                                                                                                       | A1    | eg<br>(base angles of) isosceles triangle<br>and alternate angles                      |
|                                                               | <b>Alternative method 2: shows that <math>\angle ABC + \angle BCD = 180</math> and co-interior angles</b>                                                |       |                                                                                        |
|                                                               | $\angle ACD = \angle ABC$                                                                                                                                | M1    | accept both with same letter on diagram                                                |
|                                                               | $\angle ABC = \angle BAC$                                                                                                                                | M1    | accept both with same letter on diagram                                                |
|                                                               | $\angle BCD = 180 - (\angle BAC + \angle ABC) + \angle ACD$<br>and $\angle ABC + \angle BCD = 180$<br>and alternate segment (theorem)<br>with M2 awarded | M1dep | oe<br>dep on M2                                                                        |
|                                                               | Other two correct reasons given<br>with M3 awarded                                                                                                       | A1    | eg<br>(base angles of) isosceles triangle<br>and (co-)interior angles or allied angles |
| The mark scheme for question 20(a) continues on the next page |                                                                                                                                                          |       |                                                                                        |

|                 |                                                                                                                                                                                                                                                                           |       |                                                                                                                                                        |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20(a)<br>(cont) | <b>Alternative method 3: line from midpoint of <math>AB</math> to <math>C</math> is perpendicular to <math>AB</math> and <math>CD</math></b>                                                                                                                              |       |                                                                                                                                                        |
|                 | Let $M$ be the midpoint of $AB$<br>and<br>$MC$ is perpendicular to $AB$                                                                                                                                                                                                   | M1    | any letter                                                                                                                                             |
|                 | $MC$ is perpendicular to $CD$                                                                                                                                                                                                                                             | M1    |                                                                                                                                                        |
|                 | $AB$ and $CD$ are both perpendicular<br>to $MC$<br>with M2 awarded                                                                                                                                                                                                        | M1dep | oe<br>dep on M2                                                                                                                                        |
|                 | Three correct reasons given with<br>M3 awarded                                                                                                                                                                                                                            | A1    | eg<br>(perpendicular bisector of) isosceles<br>triangle<br>and $MC$ goes through the centre of the<br>circle<br>and tangent is perpendicular to radius |
|                 | <b>Additional Guidance</b>                                                                                                                                                                                                                                                |       |                                                                                                                                                        |
|                 | Other correct methods can be found by extending one or more of the<br>lines. For example, by extending $BC$ it is possible to use corresponding<br>angles as a proof instead of alternating angles. This should be reflected<br>in the reasons required for the last mark |       |                                                                                                                                                        |
|                 | In the scheme, $\angle ACD$ (for example) means angle $ACD$ and not triangle<br>$ACD$                                                                                                                                                                                     |       |                                                                                                                                                        |
|                 | Accept equality of angles indicated by labelling with the same letter, but<br>not by arcs                                                                                                                                                                                 |       |                                                                                                                                                        |
|                 | Accept (angle) $B$ for angle $ABC$<br>Do not accept (angle) $A$ for angle $BAC$ or (angle) $C$ for angle $ACB$<br>unless intention is clear from annotation of the diagram                                                                                                |       |                                                                                                                                                        |
|                 | For the third mark in alternative method 2, accept algebraic expressions<br>for angles if clearly marked on the diagram                                                                                                                                                   |       |                                                                                                                                                        |
|                 | Do not award marks for an argument based only on assumed values of<br>angles, but ignore $60^\circ$ marked on diagram, which is for (b)                                                                                                                                   |       |                                                                                                                                                        |
|                 | Ignore an angle marked at $ADC$                                                                                                                                                                                                                                           |       |                                                                                                                                                        |
|                 | Ignore incorrect statements that do not affect the proof<br>eg $ACD$ is an isosceles triangle (but not used in proof)                                                                                                                                                     |       |                                                                                                                                                        |

(B)

|                     |                                                              |    |  |
|---------------------|--------------------------------------------------------------|----|--|
| 20(b)               | <input checked="" type="checkbox"/> $AB$ is parallel to $DC$ | B1 |  |
|                     | <input checked="" type="checkbox"/> $AC$ bisects angle $BCD$ |    |  |
|                     | <input type="checkbox"/> $AC$ bisects angle $BAD$            |    |  |
|                     |                                                              |    |  |
| Additional Guidance |                                                              |    |  |
|                     |                                                              |    |  |

Q2. (2020)

| Q          | Answer                                                                                                                                                                                                                     | Mark  | Comments                                                               |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------|
| 23         | <b>Alternative method 1: works out the value of <math>x</math> using two different methods and shows they are different</b>                                                                                                |       |                                                                        |
|            | Any one of<br>$4x + 92 = 180$<br>or<br>$5x + 30 + x + 36 = 180$<br>or $6x + 66 = 180$<br>or<br>$4x + x + 36 + 5x + 30 + 92 = 360$<br>or $10x + 158 = 360$                                                                  | M1    | oe                                                                     |
|            | ( $x =$ ) 22 with M1 seen<br>or<br>( $x =$ ) 19 with M1 seen<br>or<br>( $x =$ ) 20.2 with M1 seen                                                                                                                          | A1    | must be correct value for corresponding equation                       |
|            | A different one of<br>$4x + 92 = 180$<br>or<br>$5x + 30 + x + 36 = 180$<br>or $6x + 66 = 180$<br>or<br>$4x + x + 36 + 5x + 30 + 92 = 360$<br>or $10x + 158 = 360$                                                          | M1    | oe                                                                     |
| 23<br>cont | Any two of<br>( $x =$ ) 22 with M1 seen<br>or ( $x =$ ) 19 with M1 seen<br>or ( $x =$ ) 20.2 with M1 seen<br>and<br>should be equal                                                                                        | A1    | must be correct values for corresponding equations<br><br>oe statement |
|            | <b>Alternative method 2: uses angle sum of quadrilateral to work out <math>x</math> and then shows opposite angles do not sum to <math>180^\circ</math></b>                                                                |       |                                                                        |
|            | $4x + x + 36 + 5x + 30 + 92 = 360$<br>or $10x + 158 = 360$                                                                                                                                                                 | M1    | oe                                                                     |
|            | ( $x =$ ) 20.2 with M1 seen                                                                                                                                                                                                | A1    |                                                                        |
| 23<br>cont | 4 $\times$ their 20.2 + 92<br>or<br>5 $\times$ their 20.2 + 30 + their 20.2 + 36                                                                                                                                           | M1dep | oe                                                                     |
|            | 4 $\times$ 20.2 + 92 = 172.8<br>and should be 180<br>or<br>5 $\times$ 20.2 + 30 + 20.2 + 36 = 187.2<br>and should be 180                                                                                                   | A1    | oe<br>oe statement<br>oe<br>oe statement                               |
|            | <b>Alternative method 3: uses angle sum of 4x and <math>92^\circ</math> to work out <math>x</math> and then shows other angles do not sum to <math>180^\circ</math> or all angles do not sum to <math>360^\circ</math></b> |       |                                                                        |
|            | $4x + 92 = 180$                                                                                                                                                                                                            | M1    | oe                                                                     |
| 23<br>cont | ( $x =$ ) 22 with M1 seen                                                                                                                                                                                                  | A1    |                                                                        |
|            | 5 $\times$ their 22 + 30 + their 22 + 36<br>or<br>4 $\times$ their 22 + 92 + 5 $\times$ their 22 + 30 + their 22 + 36                                                                                                      | M1dep | oe                                                                     |
|            | 5 $\times$ 22 + 30 + 22 + 36 = 198<br>and should be 180<br>or<br>4 $\times$ 22 + 92 + 5 $\times$ 22 + 30 + 22 + 36 = 378<br>and should be 360                                                                              | A1    | oe<br>oe statement<br>oe<br>oe statement                               |

| Q          | Answer                                                                                                                                                                                                                                           | Mark  | Comments                                     |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------|
| 23<br>cont | <b>Alternative method 4: uses angle sum of <math>5x + 30</math> and <math>x + 36^\circ</math> to work out <math>x</math> and then shows other angles do not sum to <math>180^\circ</math> or all angles do not sum to <math>360^\circ</math></b> |       |                                              |
|            | $5x + 30 + x + 36 = 180$<br>or $6x + 66 = 180$                                                                                                                                                                                                   | M1    | oe                                           |
|            | $(x =) 19$ with M1 seen                                                                                                                                                                                                                          | A1    |                                              |
|            | $4 \times \text{their } 19 + 92$<br>or<br>$5 \times \text{their } 19 + 30 + \text{their } 19 + 36 + 4 \times \text{their } 19 + 92$                                                                                                              | M1dep | oe                                           |
|            | $4 \times 19 + 92 = 168$<br>and should be 180<br>or<br>$5 \times 19 + 30 + 19 + 36 + 4 \times 19 + 92 = 348$<br>and should be 360                                                                                                                | A1    | oe<br>oe statement<br><br>oe<br>oe statement |
|            | <b>Additional Guidance</b>                                                                                                                                                                                                                       |       |                                              |
|            | Alts 1 and 2 $x = 20.2$ with M1 not seen                                                                                                                                                                                                         |       | Zero                                         |
|            | Alts 1 and 3 $x = 22$ with M1 not seen                                                                                                                                                                                                           |       | Zero                                         |
|            | Alts 1 and 4 $x = 19$ with M1 not seen                                                                                                                                                                                                           |       | Zero                                         |
|            | Allow $20\frac{1}{5}$ or $\frac{101}{5}$ for 20.2, but do not allow other improper fractions for 20.2, 22 or 19 unless recovered                                                                                                                 |       |                                              |

## Q3. (2024)

| Q  | Answer                                                         | Mark | Comments    |
|----|----------------------------------------------------------------|------|-------------|
| 18 | $x^2 + y^2 = 6^2$ or $x^2 + y^2 = 36$                          | B1   | oe equation |
|    | <b>Additional Guidance</b>                                     |      |             |
|    | $x^2 + y^2 = 6^2$ followed by an incorrect evaluation of $6^2$ |      | B1          |
|    | Condone $x^2 + y^2 = r^2$ and $r = 6$                          |      | B1          |