**IGCSE (9–1) Maths - practice paper 3H mark scheme**

**Results Plus data on 90 of the 100 marks:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Paper 3** |  |  |  |  | **Edexcel averages:** |  |  |  |  |  |
| **Year** | **Paper** | **Qu. no** | **New qu. no.** | **Mean score** | **Max score** | **Mean %** |  | **ALL** | **A\*** | **A** | **B** | **C** | **D** | **E** |
| 1706 | 4H | Q07b | Q01 | 2.27 | 3 | 75.7 |  | 2.27 | 2.81 | 2.45 | 1.94 | 1.27 | 0.78 | 0.40 |
| 1606 | 3HR | Q4 | Q02 | 1.34 | 2 | 67.0 |  | 1.34 | 1.81 | 1.47 | 1.15 | 0.81 | 0.65 | 0.28 |
| 1706 | 3HR | Q06 | Q03 | 3.84 | 6 | 64.0 |  | 3.84 | 5.49 | 4.60 | 3.41 | 2.09 | 0.68 | 0.14 |
| 1706 | 3HR | Q07 | Q04 | 2.51 | 3 | 83.7 |  | 2.51 | 2.92 | 2.76 | 2.57 | 2.14 | 1.57 | 0.77 |
| 1701 | 4HR | Q06 | Q05 | 2.68 | 3 | 89.3 |  | 2.68 | 2.99 | 2.89 | 2.72 | 2.45 | 1.43 | 0.62 |
| 1701 | 4H | Q11 | Q06 | 2.85 | 5 | 57.0 |  | 2.85 | 4.27 | 3.64 | 2.78 | 1.91 | 0.92 | 0.44 |
| 1706 | 3HR | Q09 | Q07 | 2.98 | 4 | 74.5 |  | 2.98 | 3.81 | 3.46 | 2.87 | 2.09 | 1.21 | 0.52 |
| 1701 | 3HR | Q13 | Q08 | 2.54 | 3 | 84.7 |  | 2.54 | 2.89 | 2.59 | 2.47 | 2.15 | 1.73 | 0.84 |
| 1706 | 3HR | Q10 | Q09 | 4.24 | 6 | 70.7 |  | 4.24 | 5.47 | 4.68 | 4.00 | 3.21 | 2.02 | 1.02 |
| 1706 | 3HR | Q11 | Q10 | 4.89 | 7 | 69.9 |  | 4.89 | 6.73 | 6.02 | 4.66 | 2.42 | 1.11 | 0.46 |
| 1706 | 3HR | Q12 | Q11 | 4.85 | 8 | 60.6 |  | 4.85 | 6.94 | 5.49 | 4.22 | 2.86 | 1.36 | 0.46 |
| SAMs | 1H | Q13 | Q12 |  | 6 |  |  |  |  |  |  |  |  |  |
| 1706 | 3HR | Q14 | Q13 | 2.85 | 6 | 47.5 |  | 2.85 | 5.23 | 3.36 | 1.41 | 0.41 | 0.07 | 0.02 |
| 1706 | 3HR | Q15 | Q14 | 2.84 | 7 | 40.6 |  | 2.84 | 5.17 | 2.60 | 1.77 | 0.97 | 0.41 | 0.11 |
| 1706 | 3HR | Q16 | Q15 | 2.17 | 4 | 54.3 |  | 2.17 | 3.71 | 2.57 | 1.38 | 0.57 | 0.10 | 0.03 |
| 1706 | 3HR | Q17 | Q16 | 0.90 | 3 | 30.0 |  | 0.90 | 1.78 | 0.86 | 0.41 | 0.16 | 0.05 | 0.05 |
| SAMs | 1H | Q20 | Q17 |  | 4 |  |  |  |  |  |  |  |  |  |
| 1706 | 3HR | Q18 | Q18 | 2.31 | 6 | 38.5 |  | 2.31 | 4.72 | 2.18 | 0.90 | 0.36 | 0.09 | 0.02 |
| 1706 | 3HR | Q19 | Q19 | 2.97 | 6 | 49.5 |  | 2.97 | 5.04 | 3.40 | 2.01 | 0.92 | 0.31 | 0.08 |
| 1706 | 3HR | Q20 | Q20 | 0.40 | 3 | 13.3 |  | 0.40 | 0.95 | 0.25 | 0.09 | 0.03 | 0.00 | 0.00 |
| 1706 | 3HR | Q21 | Q21 | 1.41 | 5 | 28.2 |  | 1.41 | 3.06 | 1.27 | 0.37 | 0.09 | 0.02 | 0.00 |
|  |  |  |  | **50.84** | **90** | **56.5** |  | **50.84** | **75.79** | **56.54** | **41.13** | **26.91** | **14.51** | **6.26** |

**Problem-solving questions: 3, 13, 14, 19**

**Reasoning questions: 1, 11, 12, 17, 18, 20, 21**

| Q | **Working** | **Answer** | **Mark** | **Notes** |
| --- | --- | --- | --- | --- |
| 1 |  |  oe |  |  | M1 | fractions written as correct improper fractions and intention to multiply |
|  |  |  or  oe |  |  | M1 | correct cancelling or multiplication of numerators and denominators without cancelling |
|  |  |  or or  oe | shown | 3 | A1 |  or  dep on M2 |
|  |  |  |  |  |  | **Total 3 marks** |

| 2 |  | $ $ or  | 45 | 2 | M1A1  | For complete correct method for exterior angleAnswer of 135 scores M0A0 |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | **Total 2 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **3a** |  **or**  **or** 3 × 21(=63) **or** 2 × 19(=38) |  |  | M1 |   |
|  | 3 × 21 − 2 × 19 |  |  | M1 | for a complete method |
|  |  | 25 | 3 | A1 |  |
| **b** | 2 ×19 − 20 (=18) **or**21×3 – 20 – “25” (=18) |  |  | M1 | ft from (a) for a complete method to find age of 3rd person  |
|  | “25” – “18” |  |  | M1 | dep or for 18 – 25  |
|  |  | 7 | 3 | A1 | ft from answer in (a)  |
|  |  |  |  |  | **Total 6 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **4** | e.g. 2 × 2 × 7 × 12 **or**at least 3 divisions in a factor tree |  |  | M1 | for the start of a correct method e.g. may be a factor tree **or** consecutive divisionscondone 1 error |
|  | All 6 correct prime factors, no extras (2,2,2,2,3,7,(1)) |  |  | M1 | e.g. from a factor tree, ignore 1s |
|  |  | 2×2×2×2×3×7 | 3 | A1 | oe dep on M1, M1 |
|  |  |  |  |  | **Total 3 marks** |

| 5 |  | 12.8² $–$ 9.7² or 163.84 $–$ 94.09 or 69.75  |  | 3 | M1 | For squaring and subtracting[ **and**  ]  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | M1dep  | For square root [ ] |
|  |  |  | 8.35 |  | A1 | Allow 8.35 - 8.352 |
|  |  |  |  |  |  | **Total 3 marks** |

| 6 | (a) |  |  | 2 | M1 | For clearly identifying the line *x* = 1 orFor a reflection in any vertical line |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | triangle drawn ,  |  | A1 | SCB1 for a correct reflection in *y* = 1 |
|  | (b) | S  |  | 3 | M1 | Ft for **S** |
|  |  |  | rotation of with centre (1, 0) |  | A1 | rotation oe or Enlargement sf = $-$1 |
|  |  |  |  |  | A1 | (1, 0)  |
|  |  |  |  |  |  | SCB2 for a fully correct description of their transformation if **S** is in the incorrect position Note: Award M1A1A1 for a correct description even if S not drawnAward no Answer marks if more than one transformation is given. |
|  |  |  |  |  |  | **Total 5 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **7a** |  |  | 2 | B2 | If not B2 then award B1 for *a*, *b* ≠ 0 |
| b |  | (*x* − 6)(*x* + 1) | 2 | B2 | If not B2 then award B1 for  (*x* – 1)(*x* + 6) **or** (*x* – 3)(*x* – 2) **or** (*x* + 3)(*x* – 2) **or** (*x* – 3)(*x* + 2) |
|  |  |  |  |  | **Total 4 marks** |

| 8 | a |  | 0.00079 | 1 | B1 | cao |
| --- | --- | --- | --- | --- | --- | --- |
|  | b |  |  | 2 | M1 | for 20.15 × 109 **or** 20 150 000 000 or 2.015 × 10*n* where *n* ≠ 10 |
|  |  |  | 2.015 × 1010 |  | A1 | For 2 × 1010 or better |
|  |  |  |  |  |  | **Total 3 marks** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **9a** | 100 − 9.4 (= 90.6) |  |  |  | M1 |  |
|  |  oe | 607 – “57.058” |  |  | M1 |  (dep) |
|  |  | 550 | 3 | A1 | for 549.942 **or** 549.94 **or**  549.9 |
| b | oe |  |  | M2 | for a complete methodIf not M2 then award M1 for a correct first step1320 ÷ 20 (=66) **or** 0.2*x* = 1320 **or**1320 ÷ 2 (=660) |
|  |  | 6600 | 3 | A1 |  |
|  |  |  |  |  | **Total 6 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **10a** | Complete correct binary structure for selection of two counters**OR**At least one additional red branch labelled  **and** at least two blue branches labelled |  |  | M1  |  |
|  |  | Correct probability tree diagram | 2 | A1  |  |
| b |  |  |  | M1 | for  |
|  |  |  | 2 | A1 | (ft diagram) for  **or** 0.2475 **or** 24.75% |
| c |  **or**  |  |  | M1 | for one correct productft from diagram | M1 for 2 × oe (ft from (a)) |
|  |  + |  |  | M1 | for the complete methodft from diagram | M1 for 1 − 2 × |
|  |  |  | 3 | A1 |  oe **or** 0.505 **or** 50.5% |
|  |  |  |  |  | **Total 7 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **11a** | 2, 9, 18, 28, 39, 51, 63, 75, 86, 100 | Correct table | 1 | B1 |  |
| b |  |  |  | M1 | (ft from sensible table i.e. clear attempt at addition)for at least 8 points plotted correctly at end of interval  **or** for all 10 points plotted consistently within each interval in the **freq table** at the correct height |
|  |  | Correct cf graph | 2 | A1 | accept curve or line segments accept graph that is not joined to (0,15) |
| c | E.g. for a mark drawn at 25 on their cumulative frequency diagram |  |  | M1 | for intention to use 25 on cf axisft from a cumulative frequency graph provided method is shown |
|  |  | 33 – 35  | 2 | A1 | 33 - 35 ft from a cumulative frequency graph provided method is shown |
| d | E.g. reading of 66 – 68 (%) **or** reading from graph at *A* = 52**or** mark on cf axis from using *A* = 52 |  |  | M1 | for a reading taken from 52 on age axis ft from a cumulative frequency graph provided method is shown |
|  |  |  |  | M1 |  (dep)  |
|  |  | 792000 – 816000 | 3 | A1 |  for answer in the range 792000 – 816000 |
|  |  |  |  |  | **Total 8marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Question** | **Working** | **Answer** | **Mark** | **AO** | **Notes** |
| **12** | **a** |   |  |  | AO1 | M1 | for gradient |
|  |  | eg. 2 =  × 1 + *c* **or** |  |  |  | M1 | for method to find *c* |
|  |  | *y* −2 = (*x* – 1) |  |  |  |  |  |
|  |  | *y* = *x* +   |  |  |  | M1 | found values of *m* and *c* substituted in *y* = *mx* + *c* |
|  |  |  | 3*x* + 4*y* = 11 | 4 |  | A1 |  |
|  | **b** | *y* =  **or** *m* =  |  |  | AO1 | M1 |  |
|  |  |  |  |  |  |  |  |
|  |  |  | shown | 2 |  | A1 | for conclusion from correct gradients |

|  |  |
| --- | --- |
| **13** | **Scheme 1 (interior angle and angle *ADC* and an angle in triangle *ADC*)** Let *X* be midpoint of *DC* |
|  | (Angle *DEA* =)  = 108 |  |  | M1 | or for 108 seen as an interior angle |
|  | Angle *EDA* or *EAD* = (180 – 108)÷2 = 36  |  |  | M1 |  |
|  | Angle *ADC* or *ACD* = 108 – 36 = 72 **or**Angle *DAC* = 108 – 2 × 36 (=36) **or**Angle *DAC* = Angle *DAX* or *CAX* = (108 – 2 × 36) ÷ 2 (=18) |  |  | M1 | Angles may be seen on diagram |
|  | E.g*.**AX* = 5×tan72 (=15.38…) **or** *AX* = 5 ÷ tan18 (=15.38…) **or***AX* = 5×tan*ADC* **or** *AX* = 5 ÷ tan*DAX* **or***AD*2 = 102 + 102 − 2×10×10cos108 (=261.8) **or***AD* =  (=16.18) **or***AD* =  (=16.18) |  |  | M1 | or for  (=16.18…) **or**Allow 16 **or** 16.2 for *AD* throughoutNB: Allow the value on the diagram for angle *ADC* or *DAX* if used in an otherwise correct trig statement |
|  | E.g. Area =  × 10 × “15.38…” oe **or**0.5 × 10 × “16.18” × sin72 **or** 0.5 × “16.18”×”16.18”×sin36 **or**0.5 × 10 × “16.18” × sin*ADC* **or** 0.5 × “16.18”×”16.18”×sin*DAX* |  |  | M1 | dep on previous M1NB: Allow the value on the diagram for angle *ADC* or *DAX* if used in an otherwise correct area statement |
|  |  | 76.9 | 6 | A1 | for answer in the range 76.5 – 77 SC: B4 for an answer in the range 53 – 53.5  |
|  |  |  |  |  | **Total 6 marks** |

|  |  |  |
| --- | --- | --- |
| **13** | **Scheme 2 (only interior angle needed)** | Let *X* be midpoint of *DC* |
|  | (Angle *DEA* =)  = 108 |  |  | M1 | or for 108 seen as an interior angle |
|  |  *AD*2 =102 + 102 − 2×10×10cos108 (=261.8) **or***AD* = (=16.18) |  |  | M1 | Allow 16 **or** 16.2 for *AD* throughout |
|  |  *AX*2 = “261.8” − 52 (= 236.8) **or***AX*2 = “16.18”2 − 52 (= 236.8)  |  |  | M1 |  |
|  |  (=15.38..)  |  |  | M1 |  |
|  | 0.5 × 10 × “15.38” |  |  | M1 |  |
|  |  | 76.9 | 6 | A1 | for answer in the range 76.5 – 77 SC: B4 for an answer in the range 53 – 53.5 |
|  |  |  |  |  | **Total 6 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **14a** | 3×2×*x*2 − 3×2*x* − 12 |  |  | M1 | for one of 3×2×*x*2 (=6*x*2) or −3×2*x* (=6*x*) or −12 |
|  |  |  | 2 | A1 |  |
| b | 6 × 22 − 6 × 2 − 12 |  |  | M1 | substitute *x* = 2 in (a) ft from answer to (a) (must be a quadratic expression) |
|  |  | 0 | 2 | A1 |  |
| c |  |  |  | M1 | ft from answer to (a) (must be a quadratic expression) |
|  | *x* = 1 , 0 |  |  | A1 | for both correct solutions |
|  |  | 1, 0 | 3 | A1 | for *k =* 1 and *m* = 0 |
|  |  |  |  |  | **Total 7 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **15** |  |  |  | M1 | both terms in original denominator multiplied by *y* |
|  | e.g. **or***dy* – b = *ax* – *cxy*  |  |  | M1 | for isolating terms in *x* and non *x* terms correctlyft from *cxy* + *d* = *ax* + *b* **or** *cx* + *dy* = *ax* + *b* |
|  |  |  |  | M1 | for taking out a factor of *x* correctly provided there are two terms in *x* |
|  |  |  | 4 | A1 | for oe e.g.  |
|  |  |  |  |  | **Total 4 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **16** | 12 × (12+ 6) = 9 × (9 + *BC*) oe **or** 12 × (12+ 6) = 9 × *AC* oe **or***AC* = 24 |  |  | M1 |  |
|  |  oe **or**24 – 9  |  |  | M1 | for a complete method |
|  |  | 15 | 3 | A1 |  |
|  |  |  |  |  | **Total 3 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Question** | **Working** | **Answer** | **Mark** | **AO** | **Notes** |
| **17** | **ai** |  | (0, 5) | 1 | AO1 | B1 |  |
|  | **aii** |  | (3, 10) | 1 |  | B1 |  |
|  | **aiii** |  | (1, 5) | 1 |  | B1 |  |
|  | **b** |  | translation  | 1 | AO1 | B1 |  |
|  |  |  |  |  |  |  | **Total 4 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **18** |  with subtraction **or****or**oe  |  |  | M1 | for eliminating one variable multiplication of equation(s) to get same multiple of *y* with subtraction (condone one arithmetic error) **or**either rearrangement of one equation and then correct substitution into second equation (condone algebraic error in rearrangement)  |
|  | E.g.  **or** 4*x*2 – 4*x* – 8 = 0  |  |  | A1 | reduction to a correct 3 term quadratic; terms may not all be ‘on the same side’ |
|  | E.g. (*y* − 2)(*y* −4) (= 0) or 4(*x* − 2)(*x* + 1) (=0)  |  |  | M1 | ft if first M1 awarded and equation is quadraticfor correct factorisation **or** correct substitution into formula |
|  |  |  |  | A1 | for *y* = 2, *y* = 4 or *x* = 2, *x* = −1 correct *x* or *y* values implies previous M1 |
|  |  or   or  |  |  | M1 |  (dep on the previous M1) for correct substitution to find **both** values |
|  |  | *x* = 2, *y* = 2 or *x* = −1, *y* = 4 | 6 | A1 | values for *x* and *y* must be correctly paireddep on M1 awarded |
|  |  |  |  |  | **Total 6 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **19** |  (=22896π = 71930) |  |  | M1 | for volume of cone |
|  | (=31104*π* = 97716) |  |  | M1 | for volume of hemi-sphereNB : 54000*π* or 169646 implies first two method marks |
|  | + oe |  |  | M1 | (dep on at least M1)for forming an equation with correct volume expression for cylinder |
|  | = 30 |  |  | M1 |  |
|  | 2 × “30” |  |  | M1 | (dep previous M1) |
|  |  | 60 | 6 | A1 |  |
|  |  |  |  |  | **Total 6 marks** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **20** |  **or** **or** |  |  | M2 | for correct expansion If not M2 then award M1 for 3 terms correct from  |
|  |  | Shown |  | A1 | for correct factorised expression from correct working(dep on M2) |
|  |  |  |  |  | **Total 3 marks** |
|  | **Alternative method** |  |  | M1 | for correct factorisation |
|  |  |  |  | M1 | for correct factorisation and substitution (implies B1) |
|  |  | Shown | 3 | A1 | for correct factorised expression (dep on M2) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **21** |  |  |  | M1 |  |
|  |  oe oe |  |  | M1 | (independent) correct expansion of (*x* – 2)2 or (*x* – 3)2 |
|  |  (=) |  |  | A1 | correct quadratic for *BD*2 with all terms expanded may not be simplified |
|  | Area = 2*BD*2 oe **or**Area = 2 × (“”) |  |  | M1 | (independent) |
|  |  |  | 5 | A1 |  |
|  |  |  |  |  | **Total 5 marks** |