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| Guidance on the use of codes for this mark scheme |
| M | Method mark |
| A | Accuracy mark |
| B | Mark awarded independent of method |
| cao | Correct answer only |
| oe | Or equivalent |
| ft | Follow through |

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| **Question** | **Working** | **Answer** | **Mark** | **AO** | **Notes** | **Grade** |
| **1 a** **b** **c** |  | (*b*, –*a*)(–*a*, –*b*)(–*b*, *a*) | B1B1B1 |  | B1 caoB1 caoB1 cao | B |
| **3** |
| **2** |  | E.g. | B3 | 3 | B1 for correct reflection of small lengthsB1 for correct reflection of large lengthsB1 for complete correct diagram | B |
| **3** |
| **3 a** **b** |  | (–5, –2)(–*b*, –*a*) | M1A1A1 |  | M1 process of drawing a grid to assistA1 caoA1 cao | B |
| **3** |
| **4 a** **b**  | (4, 3) → (–4, –3) in first reflection(–4, –3) → (–4, 3) in second | (–4, 3)(–*a*, *b*) | M1A1A1 |  | M1 finding first reflected pointA1 caoA1 cao | B |
| **3** |
| **5** | Divide all points by 2 to give | (1, 1)(3, 1)(3, 2) | M1A2 | 3 | M1 for method of halving all pointsA2 if all three correctA1 if only two are correct | B |
| **3** |
| **6 a** **b** **c i** **ii** **iii** |  | E.g. A rectangle is a special quadrilateral that has four right angles, and the opposite sides are of equal length.The mathematically important words are: quadrilateral, right angles, equal.YesA square is a special type of rectangle, because it fits the definition in part **a**.Two sides and two angles the same.All sides and angles the same.All sides and angles different. | B1B1B1B1B1B1B1 | 2 | B1 for an accurate descriptionB1 for suitable key words such as parallel,perpendicular, right angles, equalB1 for yesB1 for clear explanationB1 for a correct statementB1 for a correct statementB1 for a correct statement | B |
| **7** |
| **7 a i** **ii** **iii** **iv** **b** **c** **d** |  | A kite has two pairs of equal adjacent sides.A parallelogram has opposite sides parallel and equal in length.A rhombus has four equal sides.A trapezium has a pair of opposite sides parallel. It is an Isosceles trapezium if the sides that are not parallel are equal in length and both angles coming from a parallel side are equal.A rhombus has 4 equal sides with opposite sides parallel so this fits the definition of a parallelogram.Although opposite sides in a parallelogram must be equal, all four sides do not have to be equal so a parallelogram is not necessarily a rhombus.There are two pairs of allied angles. Each pair adds up to 180°. So if you change the obtuse angle to acute, the other angle becomes obtuse.Irregular (see example). If it was not irregular as one angle decreases the other would increase (see part **c**) | B1B1B1B1B2B2B2 | 23 | B1 for a correct statement.B1 for a correct statementB1 for a correct statementB1 for a correct statementB1 for rhombus being parallelogramB1 for parallelogram not being rhombusB1 for a correct statementB1 for use of diagrams to helpB1 for a correct statementB1 for use of diagrams to help | B |
| **8** |
| **8 a i** **ii** **iii** **iv** **b** |  | Suitable sketch of a quadrilateral that has:1 line of symmetry2 lines of symmetry3 lines of symmetryno lines of symmetry1 line of symmetry – order 12 lines of symmetry – order 23 lines of symmetry – order 3no lines of symmetry – order 1 | B1B1B1B1B1B1B1B1 | 2 | B1 for a correct shapeB1 for a correct shapeB1 for a correct shapeB1 for a correct shapeB1 caoB1 caoB1 caoB1 cao | B |
| **8** |
| **9 a** **b** |  | Find the perimeter by adding up the distance around the edge.i.e. 10 + 2 + 5 + 3 + 2 + 3 + 3 + 2 = 30 cmTwo different ways of working out the area of the shape for example: | B2B2 | 23 | B1 for clear explanationB1 for also showing it doneB1 for first example.B1 for second example | B |
| **4** |
| **10 a** **b** | Length of side = *x*Then, using Pythagoras, *x*2 + *x*2 = 2022*x*2 = 202*x* = 20 ÷ = 14.142136Perimeter = 4*x*= 56.568542 | 56.6 cmSide length *x*, so, using Pythagoras, 2*x*2 = 82 = 64Area = *x*2 = 64 ÷ 2 = 32 cm2 | M1A1M1A1M1A1 | 3 | M1 for using Pythagoras’ theoremA1 for answer to at least 3 dpM1 for multiplying *x* by 4.A1 for answer to either 1 or 2 dpM1 for process of using Pythagoras’ theoremA1 for clear presentation showing given result | B |
| **6** |

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| **11 a** **b** **c** |  | Stays the same – orientation, lengths and angles.Changes – the position on any grid.Stays the same – lengths and angles.Changes – the position on any grid, orientation.Stays the same –lengths and angles.Changes – the position on any grid, orientation. | B1B1B1B1B1B1 | 2 | B1 for a clear statementB1 for a clear statementB1 for a clear statementB1 for a clear statementB1 for a clear statementB1 for a clear statement | B |
| **6** |
| **12** |  | E.g. The trapezium has only one pair of opposite sides parallel, the parallelogram has two pairs of opposite sides parallel.The trapezium has rotational symmetry of order 1, the parallelogram has rotational symmetry of order 2. | B1B1 | 2 | B1 for a correct statementB1 for another correct statement | B |
| **2** |
| **13** |  | No.Need to know if it is the single angle or one of the repeated angles (see diagrams). | B1B1 | 2 | B1 for noB1 for clear explanation | B |
| **2** |
| **14** |  | A is the only one with all the angles are the same/the only equilateral triangle.B is the only one with a right angle/the only right-angled triangle.C is the only scalene triangle.  | B1B1B1 | 2 | B1 for any possible reasonB1 for any possible reasonB1 for any possible reason | B |
| **3** |

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| **15** | Split the shape as shown in the diagram.Area = 3 × 2.5 – π(1.2)2+ 1 × 2 + 2 × 6.5= 7.5 - 4.52389 + 2 + 13= 17.97611 cm2 | 18.0 cm2 | M1M1A1A1 | 3 | M1 for process of splitting shape upM1 for method of finding area of each partA1 for answer to at least 3 dpA1 for answer to either 0, 1 or 2 dp | B |
| **4** |
| **16 a** **b** **c**  |  | e.g. 1 cm × 1 cm × 24 cm1 cm × 2 cm × 12 cm2 cm × 3 cm × 4 cme.g. 2 cm × 3 cm × 4 cme.g. base 2 cm, height 12 cmbase 4 cm, height 6 cm | B3B1B1 | 23 | B1 for each cuboid with a volume of 24 cm3.B1 for any *a*, *b*, *c* where 2(*ab* + *bc* + *ac*) = 52.B1 for two lengths ad where *ab* = 12 | B |
| **5** |
| **17** | Using angles on a straight line: angle ADB = 180° – 2*x*Using angles in a triangle in triangle ADB: *x* + 34° + 180° – 2*x* = 180°–*x +* 34° = 0*x* = 34°Using angles in a triangle in triangle BCD:2*x* + 74° +angle BCD(A) = 180°angle BCD(A) = 180° – 2*x* – 74°= 180° – 68° – 74°= 38° | Angle BCA = 38° | M1A1M1A1 | 2 | M1 for finding *x* using angles in triangle and creating an equationA1 for *x* = 34°M1 for using angles in a triangle to find angle BCDA1 cao | B |
| **4** |

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| **18** |  | A is the only 6 sided shape/the only one with all sides the same shape.B is the only one not a prism/the only pyramid.C is the only one with a rectangular base. | B1B1B1 | 2 | B1 for a valid reasonB1 for a valid reasonB1 for a valid reason | B |
| **3** |
| **19** |  | For example, split the compound shape into different shapes.Work out the area of the large rectangle and subtract the areas that have been cut away. | B1B1B1 | 3 | B1 for first way.B1 for another way using a different shape to the first.B1 for a different way to the first two | **B** |
| **3** |
| **20 a** **b** |  | FalseThe missing lengths of the diagram have not been found to add on to the lengths given.FalseThe parts have been assumed to have the same area, but they do not. | B1B1B1B1 | 2 | B1 for falseB1 for clear explanationB1 for false.B1 for clear explanation | B |
| **4** |
| **21** | Based on the diagram 3 × 4 = 12 tables Room around length of tables is 20 – (4 × 3) = 8 m8 m ÷ 5 gaps = 1.6 m which is more than 1.5 mRoom around width of tables is 18 –(4 × 2) = 10 m10 m ÷ 4 gaps = 2.5 m which is more than 1.5 m. So plenty of space around each table.12 × 7 people = 84 people can be seated  | So based on the layout there would be enough seats. | M1A1A1M1A1A1 | 3 | M1 for process of looking for a suitable design and testing itA1 for a solution that worksA1 for showing the solution worksM1 for process of finding out number of people who can be seatedA1 for correct number of people for the layout A1 for complete solution well explainedAllow variations based on variations that fit with criteria, for example either side of stage | M |
| **6** |
| **22** |  | Height of cylinder and radius or diameter of cross section.  | B1B1 | 2 | B1 for heightB1 for radius | M |
| **2** |

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| **23 a** **b** **c** **d** | 42° – 25° = cos 25°AB = 70 × cos 25°= 63.441545 = sin 25°CB = 70 × sin 25°= 29.583278 = tan 42°BD = AB × tan 42°= 57.123024CD = BD – BC = 27.539745 | 17°63.4 m29.6 m27.5 m | M1A1M1A1M1A1M1A1M1A1 | 3 | M1 method of subtractingA1 caoM1 correct trig statementA1 63.4 to either 0, 1 or 2 dpM1 correct trig statementA1 63.4 to either 0, 1 or 2 dpM1 correct trig statementA1 63.4 to either 0, 1 or 2 dpM1 for process of subtracting A1 for 27.5 to either 0, 1 or 2 dp | M |
| **10** |
| **24 a i** **ii** **iii** **iv** |  | 80*π* m2: correct Area = (82 × *π*) + (42 ×*π*) = 64*π* + 16*π* = 80*π*208*π* m2: squared values on diagram multiplied by π and added24*π* m2: multiplied radii by 2 instead of squaring them 48*π* m2: subtracting 42*π* from 82*π* instead of adding. | B1B1B1B1 | 23 | B1 for correct.B1 for valid reasonB1 for valid reasonB1 for valid reason | M |
| **4** |

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| **25** |  |  | B1B1B1B1 | 3 | B1 for process of finding triangle with height 4 times greater than the rectangleB1 for constructing line bisector of base of rectangleB1 for stepping off 4 heights of rectangleB1 for completing correct triangle | M |
| 4 |
| **26 a i** **ii** **iii** **iv** **v** **b** |  | TrueTrueFalse. Two obtuse angles will add up to more than 180° which is more than the sum of the angles in a triangle.TrueFalse. Two right angles add up to 180° which is the sum of the angles in a triangle, so the third angle would have to be 0°.If you draw a line between two parallel lines, the two allied angles formed add up to 180°, which gives nothing left for a third angle. | B1B1B1B1B1B1B1 | 2 | B1 for a clear diagramB1 for a clear diagramB1 for clear explanationB1 for a clear diagramB1 for clear explanationB1 for clear explanationB1 for clarity of the communication | M |
| **7** |
| **27 a** **b** | *x* = 180° – (90° + 15°)= 180° – 105°Angle ACD = 15°Alternate anglesBCD = 90° + 15° | 75°105° | M1A1B1M1A1 |  | M1 using angles in a triangleA1 caoB1 for recognition of alternate anglesM1 for using angles in a triangle and addingA1 cao | M |
| **5** |
| **28** |  | Their interior angles are 120° and 3 × 120° = 360°This is the total of the angles around a point. | B1 | 2 | B1 for a clear explanation | M |
| **1** |
| **29** | Using Pythagoras*x*2+ 1.52 = 52 *x*2 = 25 – 2.25*x* =  = 4.734165  | 4.73 m | M1M1A1A1 | 3 | M1 for process of applying Pythagoras theoremM1 for correct Pythagoras statementA1 for A1 for 4.73 correct to 2 or 3 dp | M |
| **5** |
| **30 a** **b** |  | Scale factor is 3The side lengths of A are one-third the side lengths of C, so the scale factor will be .Where the lines cross is the centre of enlargement, this point is (–18, 14)  | B1B1B1B1 | 23 | B1 caoB1 for scale factor  B1 for explaining the linesB1 for correct centre. | M |
| **4** |
| **31** |  | The sum of the areas of the two smaller semicircles is equal to the area of the larger semicircle. | B1 | 23 | B1 for a clear explanation | H |
| **1** |
| **32**  |  | AC is 5 cm because, triangle ABC is a 5, 12, 13 special right-angled triangle.Triangle ACD is a right-angled triangle and a 3, 4, 5 triangle, giving CD the length 4. | B1B1 | 23 | B1 for explaining AC as being 5 cmB1 for completing the explanation for DC to be 4 cm | H |
| **2** |

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| **33** | (Horizontal distance in air)2 = 3002 + 5002 = 340 000Horizontal distance in air = = 583.0952 m | 583 m | M1A1A1 | 2 | M1 for sorting one length by PythagorasA1 for A1 for answer correct to 1, 2 or 3 sf | H |
| **3** |
| **34** |  | Diameter 5 cm, height 13 cmOrDiameter 13 cm, height 5 cm | B1B1 | 2 | B1 for first correct setB1 for second correct set | H |
| **2** |
| **35 a** **b** | 4*x* = 3(*x* + 3)4*x* = 3*x* + 9*x* = 9So perimeter of square is 4 × 9 = 36 cm*y* = = *z*2=122- 62*z*2 = 144 – 36 = 108*z* = | 36 cmSo *y* is greater  | M1M1A1M1A1B1M1A1B1 | 23 | M1 for process of setting up equationM1 for *x* = 9A1 caoM1 for using Pythagoras’ theoremA1 either surd form or answerB1 for creating suitable diagram to assistM1 for use of Pythagoras’ theoremA1 for surd form or answerB1 cao provided evidence of calculation seen | H |
| **9** |
| **36** |  | Each length is a multiple of 2.5, so by dividing by 2.5 we can see the ratio of all the sides.This gives us 3, 4, 5 and 6The sides in the ratio 3, 4 and 5 will make a right-angled triangle, hence the one to be left out is the one that is 6 × 2.5 = 15 cm. | M1A1A1 | 2 | M1 for process of finding ratio of sidesA1 for explaining why the three chosen fitA1 for 15 cm provided explanation alongside | M |
| **3** |
| **37** |  | If all the shapes are congruent then they are identical in size, so they must have tessellated, all joining together and leaving no gaps. | B1 | 2 | B1 for clear explanation |  |
| **1** |
| **38** |  | Find the factor pairs of 60 to give1 × 60, 2 × 30, 3 × 20, 4 × 15, 5 × 1, 6 × 10 | M1A1 | 3 | M1 for process of looking for factor pairsA1 for all six stated | M |
| **2** |
| **39** | DE = 6 cm, CH = 7 cm, CG = 8 cmSide length of the square is 10 cm.Subtract area of triangles DEH, HCG, AEF and BFG from the area of the square.Area of DEH = 0.5 × 3 × 6 = 9 cm2Area of HCG = 0.5 × 7 × 8 = 28 cm2Area of AEF = 0.5 × 4 × 4 = 8 cm2Area of BFG = 0.5 × 2 × 6 = 6 cm2Area of square = 10 × 10 = 100 cm2So area of shaded shape = 100 – (9 + 28 + 8 + 6)= 100 – 51= 49 cm2 | Area = 49 cm2 | M1M1M1A1 | 3 | M1 for process of finding missing lengths and marking them on diagramM1 for method of finding area of a triangleM1 for subtraction of areasA1 cao | M |
| **4** |
| **40** | The area of the garden is 6.5 × 4.8 = 31.2 m2The area of the small blue squares are 0.82 = 0.64 m2 Four of them make one large blue squareThere are the equivalent of 12 small blue squares to be covered by topsoil.Area = 12 × 0.64 = 7.68 m2 The volume of soil needed is 7.68 m2 × 0.5 m = 3.84 m3Number of bags of topsoil needed = 3.84 ÷0.75 = 5.12Assume she will need 5 bags.So will need about 5 bags Cost of topsoil = 5 × 73.30 = £366.504 slabs that cover 4 × 0.64 = 2.56 m2The grass needed is to cover 31.2 – (7.68 + 2.56) = 20.96 m2Use approximately 50 g per square metre.50 g × 20.96 = 1048 g So assume 2 × 500g bags will be needed which will cost 2 × £19.99 = £39.98Total cost will be £366.50 + £39.98But note no cost given for the paving stones. | £406.48 | M1M1A1A1M1A1B1B1A1M1M1A1B1A1A1B1 | 3 | M1 for process of finding area of gardenM1 for finding area of shaded squaresA1 for 7.68A1 for 3.84M1 for dividing volume by 0.75A1 for 5.12B1 for stating 5 bags neededB1 for £366.50A1 for 2.56M1 for process of finding area of grassM1 for multiplying area by 50A1 for 1048B1 for stating 2 bags neededA1 for 39.98A1 caoB1 for explaining that the stones are not included in the price. | M |
| **16** |

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| **41** |  | SometimesAn example of when not true and an example of when trueShape A: perimeter = 14 cm, area = 10 cm2Shape B: perimeter = 16 cm, area = 12 cm2Shape C: perimeter = 18 cm, area = 8 cm2Statement true for A and B, but false for B and C | B1B2B1 | 2 | B1 for sometimesB1 for example that shows it can be trueB1 for example that shown it can be falseB1 for clear communication of both | M |
| **4** |
| **42** |  | TrueDemonstration of proof of area triangle equal to half area of rectangle true also for non-right angle triangle.Area of triangle ABT = half of AEBT= half of 36 cm2 = 18 cm2Area of triangle CTB = half of CTBF= half of 12 cm2 = 6 cm2Area of triangle ABC = 18 + 6 = 24 cm2 =  × 4 × 12  | B1B1M1 | 23 | B1 for trueB1 for clear explanationM1 for concise communication with clear diagrams | M |
| **3** |

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| **43** |  | A rotation of 90°anticlockwise around point (2, 2) | M1A1A1B1 | 3 | M1 for a process of finding the centre of rotation.A1 for indicating 90° anticlockwise (or 270° clockwise)A1 for indicating centre of rotation as (2, 2)B1 for full, clear description providing all information needed | M |
| **4** |
| **44** | Area of front and back = 2 × 12 × 25 = 600 m2Area of sides = 2 × 12 × 12 = 288 m2Area of openings = 40 × 2 × 1 = 80 m2Total area to be painted = 600 + 288 – 80 = 808 m2With 2 coats of paint area = 2 × 808 = 1616 m2Number of litres of paint needed = 1616 ÷ 16 = 101 litres.Number of cans of paint = 101 ÷ 10 = 10.1So 11 cans are needed.Cost of paint = 11 × £25 = £275Assume painters work 5 days per week.Number of days = 2 × 5 = 10Cost of painters = 10 × 3 × 120 = £3600Total cost = £275 + £3600 + £500 = £4375Add 10%: £4375 × 1.1 = £4812.50Add 20% VAT: £4812.50 × 1.2 = £5775 | The builder should charge the council £5775. | M1M1A1M1A1M1A1M1A1A1M1M1A1C2 | 23 | M1 for correct formula for area of rectangleM1 for correct method of finding total surface areaA1 for 808 caoM1 for correct method of finding number of cansA1 for correct number of cans usedM1 for method of finding cost of cansA1 for 275 caoM1 for method of calculating cost for two days A1 for 3600 caoA1 for 4375 caoM1 for correct calculation of 10%M1 for correct calculation of 20%A1 for correct total cost 5775C1 for clear explanation marks with structure and technical use of language in explanation andC1 for stating any necessary assumptions | M |
| **14** |
| **45 a** **b** **c** | Area of face = 42 = 16 m2Area of circle = *πr*2Using π= 3.142, area = *π*1.22= 4.52448 m2Remaining surface area of front face = 16 – 4.52448 = 11.47552 m2Total remaining surface area:front and back = 2 × 11.47552 = 22.95104 m2Area of other four sides = 4 × 16 = 64 m2Total = 64 + 22.95104= 86.95104 m2Volume of original cuboid = 43 = 64 m3Volume of cylinder = *πrh*= *πr*24= 4.52448 × 4= 18.09792 m3Remaining volume = 64 – 18.09792 = 45.90208 m3Light blue paint = outside area ÷ coverage of 1 litre of paint = 87 ÷ 9 = 9.666Surface area inside cylinder = 2*πrh*2 × 3.142 × 1.2 × 4=30.1632 m230.1632 ÷ 9 = 3.3515 | 87.0 m245.9 m3Light blue = 9.7 litresDark blue = 3.4 litres | M1M1A1A1A1A1A1M1A1M1A1A1M1A1M1A1A1 | 3 | M1 for the correct method of finding area of a rectangleM1 for correct method of finding area of a circleA1 for correct area of circleA1 for correct area of face with circleA1 for correctly combining front and backA1 for correct area of the other 4 sidesA1 for correct total area, rounded to 2 ,3 or 4 sfM1 for correct method for finding volume of cubeA1 for 64M1 for correct method for finding volume of cylinderA1 for a correct volume of cylinder (any rounding)A1 for correct total volume, rounded to 2,3 or 4 sfM1 for dividing total outside surface by 9A1 for correct answer rounded to 1,2,3 or 4 sfM1 for correct method of finding curved surface areaA1 for a correct surface area (any rounding)A1 for correct answer to 2,3 or 4 sf | M |
| **17** |
| **46** |  | Yes, he is correctThis is one of the conditions for being able to draw a triangle | B1 | 23 | B1 for clear communication that he is correct | M |
| **1** |
| **47** |  |  | B4 | 3 | B1 for each different possible triangle shown and clearly labelled | M |
| **4** |
| **48** | Draw the locus. | d The locus is none of these as it is a point. | B1B1M1 | 3 | B1 for stating d is the only correct optionB1 for a clear explanation of whyM1 for clear communication using diagrams to illustrate answer | M |
| **3** |
| **49** | Angles in a in triangle add up to 180°You can split any quadrilateral into two triangles.Therefore the interior angles of any quadrilateral = 2 × 180o |  | B1M1B1 | 2 |  B1 for clear explanationM1 for communication with clear diagram B1 for showing inter angles of quadrilateral = 2 × 180° | M |
| **3** |
| **50** |  | A line of symmetry has the same number of vertices on each side of the line so there is an even number of vertices and therefore an even number of sides.  | B2M1 | 2 | B1 for line of symmetry and number of vertices linkB1 for reference to even number of verticeso.e.M1 for use of diagram to illustrate answer | M |
| **3** |
| **51 a** **b** **c** |  | Suitable diagram, e.g.Suitable diagram, e.g. as part **a**In a parallelogram opposite sides are equal.In a trapezium at least one set of opposite sides are parallel.Therefore every parallelogram is also a trapezium. | B1B1B1M1 | 23 | B1 for a correct diagramB1 for a correct diagramB1 for a correct diagram of a parallelogramM1 for a correct explanation alongside the diagram | M |
| **4** |
| **52** |  | Always trueFor any polygon to go around the outside of the shape you must turn through 360° to get back to where you started. Therefore the external angles of every polygon sum to 360o. | B1B1M1 | 2 | B1 for always trueC1 for a satisfactory explanationM1 for use of diagram to illustrate answer |  |
| **3** |

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| **53** | Ratio = 6 : 5 : 76 + 5 + 7 = 18Sum of the angles in a triangle = 180°So 180° ÷ 18 = 10°Therefore the angles are:6 × 10° = 60°5 × 10° = 50°7 × 10° = 70°Check60° + 50° + 70° = 180° | 60°, 50°, 70° | M1B1M1B3M1 | 2 | M1 for summing parts of ratioB1 for clear statement regarding angle sum of triangleM1 for dividing 180° by 18B1 for each correct angle foundM1 for showing the checking of answer sum to 180°. |   |
| **7** |
| **54 a**  **b** |  | Interior angle of a equilateral triangle is 60°Interior angle of a square is 90°Interior angle of a regular hexagon is 60°All three are factors of 360o so these shapes will tessellate around a point. This is not true for other regular polygons as their interior angles are not factors of 360.Interior angle of a regular octagon is 135oInterior angle of a square is 90oUsing a similar argument to part **a**: 2 × 135° + 90° = 270° + 90° = 360o | M1M1B1B1M1 | 2 | M1 for clear explanation of all three shapesM1 for use of clear diagrams alongside the explanationB1 for clear explanationB1 for clear explanationM1 for use of clear diagrams alongside the explanation |  |
| **5** |
| **55** |  | All three sides (SSS)Two sides and the included angle (SAS)Two sides and another side angle (SSA)Two angles and a side (ASA, or AAS) | B4 | 3 | B1 for each correct statement | M |
| **4** |

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| **56 a** **b** **c**  **d** |  | TrueIn a parallelogram opposite sides are parallel.In a rhombus opposite sides are parallel and all sides are the same length.So a rhombus is a type of parallelogram.In a square all sides are the same length.So a rhombus with right angles must be a square.TrueA rhombus must be a parallelogram (part **a**) but a parallelogram does not all sides the same length so it does not have to be a rhombus.TrueUsing the diagram of a trapezium above, you see each pair of angles are allied angles, each pair adding up to 180°, so each pair can only have a maximum of one acute angle, hence the whole shape can have no more than two acute angles.TrueA quadrilateral can have three acute angles,e.g. 80°, 80°, 80° and 120° | B1B1B1B1B1M1B1B1M1B1B1M1 | 3 | B1 for trueB1 for clear explanationB1 for clear explanationB1 for trueB1 for clear explanationM1 for clear use of diagram alongside the explanation B1 for trueB1 for clear explanationM1 for clear use of diagrams alongside the explanationB1 for trueB1 for clear explanation alongside a clear diagramM1 for clear use of a correct diagram | M |
| **12** |

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| **57** |  | Look at what sides and/or angles you have been given and what you need to calculate.Use Pythagoras, theorem when you need to work out one side lengths and you know the other two side lengths.Otherwise use sine, cosine or tangent when you need to work out an angle or a side. | B1B1 | 3 | B1 for clear Pythagoras explanationB1 for clear right angled trig explanation | M |
| **2** |
| **58 a i** **ii** **b i** **ii** |  | A suitable simple reflectionA mirror line that is parallel to one of the sides of the shape A suitable simple rotationA centre of rotation that is not on an extension of one of the sides of the shape.  | B1M1B1M1 | 23 | B1 for a diagram of a simple reflectionM1 for a clear explanationB1 for a diagram of a simple rotationM1 for a clear explanation  | M |
| **4** |
| **59 a** **b** **c** |  | The lengths change as does the position of the shapeThe angles stay the same.For exampleScale factor and centre of enlargement.Find the centre of enlargement by choosing two points on the original shape and their image points. Draw straight lines joining these points on the original image and the corresponding points on the image. Where the lines cross is the centre of enlargement.Work out the scale factor found by dividing the length of a side on the image by the length of the corresponding side on the original shape.OR by dividing distance of a point on the image from the centre of enlargement by the distance of a corresponding point on the original shape from the centre of enlargement. | B1B1B1B1B1B1B1 | 2 | B1 for clear statementB1 for clear statementB1 for use of a clear exampleB1 caoB1 caoB1 for clear explanationB1 for clear explanation | B |
| **7** |
| **60 a** **b** |  | When a shape has been translated the orientation is the same.When it has been reflected its orientation is different.Rotating a rectangle about its centre: all the vertices move and the shapes remain superimposed on each other.Rotating about one of its vertices: all the other vertices move and as the angle increases the shapes will no longer be superimposed. | B2M1B1M1B1M1 | 2 | B1 for comment about orientation staying the same in translationB1 for comment about orientation being different in rotationM1 for a clear diagram alongside the explanationB1 for clear explanationM1 for good diagram alongside explanationB1 for clear explanationM1 for use of diagram to illustrate explanation |  |
| **7** |
| **61** | Cross-sectional area is a quarter of circle with radius 1.5 cm and a rectangle 1.5 cm by 6.5 cmArea of quarter circle = *π*1.52= 1.7671459 cm2Area of rectangle 1.5 × 6.5 = 9.75 cm2Total area = 1.7671459 + 9.75 = 11.517146 cm2Total volume of wood =11.517146 × 12 000 = 138 205.75 cm2Convert this to m2 by dividing by 1 000 000= 0.13820575 m2 | 138 000 cm2 or 0.14 m2  | M1A1B1B1M1A1 | 23 | M1 for method of finding area of the quadrantA1 for any rounding to 4 or more sfB1 for 9.75B1 for any rounding to 4 or more sfM1 for method of finding volumeA1 for correct answer rounded to either 2 or 3 sfAccept alternative cubic metre answer given correctly to 2 or 3 sf | M |
| **6** |
| **62 a** **b** **c** | Triangle 11 will move round to sit next to face 13, square 4 will move round to be next to face 12, leaving face 2 opposite to face 13.  | 14 faces: the same as the number of polygons in the net.13I would create the shape first then draw what I see from above as the plan and from the side as the elevation. Once created, I can measure the lengths and angles concerned. | B1B1B1B1M1B2 | 2 | B1 for the 14 facesB1 for clear explanationB1 for face 13B1 for clear explanationM1 for use of diagrams alongside the explanationB1 for an explanation of the planB1 for explanation of elevations |  |
| **7** |
| **63** | Circumference of wheel = *πd*= *π* × 68 = 213.6283 cm10 km = 10 × 1000 × 100 cm= 1 000 000 cmNumber of revolutions = 1 000 000 cm ÷ 213.6283 cm = 4681.028 | 4681 complete rotations | M1A1B1M1A1 | 2 | M1 for method of calculating circumference of wheelA1 for full unrounded answerB1 for use of 1 000 000 as a conversion factor either way roundM1 for correct division with common unitsA1 for cao  | M |
| **5** |
| **64** | *x*2 = 52 + 32 = 34*x* = = 5.8309519 | *x* = 5.8 km | B1M1M1M1A1 | 2 | B1 for use of a correct diagramM1 for explanation of how and why using Pythagoras’ theoremM1 for correct application of Pythagoras’ theoremM1 for correct method of finding hypotenuseA1 for correct rounding to 2 or 3 sf | M |
| **5** |

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| **65** | Let *c* = the height of the chimney = tan 53°*x* = *c* tan 53°= tan 62°30 + *x* = *c* tan 62°*x* = *c* tan 62° – 30Combining equations to eliminate *x*:*c* tan 53° = *c* tan 62° – 30Rearrange to get *c* on one side of the equation30 = *c* tan 62° – *c* tan 53°30 = *c* (tan 62° – tan 53°)*c* = 30/(tan 62° – tan 53°)= 54.182761 m | 54.2 m | B1M1A1M1A1M1M1A1 | 2 | B1 for clear correct diagram usedM1 for correct use of trig with *x*, *c* and angle 53° or 37°A1 for correct equation having *x* as subjectM1 for correct use of trig with *x*, *c* and angle 62° or 28°A1 for correct equation in format to combine with first equationM1 for correctly eliminating *x*M1 for correct equation with *c* as subjectA1 for correct answer rounding to 2 or 3 sf | M |
| **8** |
| **66 a** **b** **c** |  | It is always trueIf you include the option of 1 × 1 × *a* then you can build a cuboid for any number of cubes.You can only make one cuboid for a prime number of cubes because this is the only option as the only factors of a prime number are 1 and itselfYou can make more than one cuboid if the individual number of cubes has more than 3 factors not including itselfE.g. 30 (factors 1, 2, 3 and 5) | B1B1B1B1B1 | 23 | B1 for always trueB1 for clear explanationB1 for clear explanation using primesB1 for clear explanation for when more than 1 cuboid could be madeB1 for use of examples to illustrate the explanations | M |
| **5** |
| **67 a** **b** **c** |  | YesYesYesYes | B1B1B1B1B1B1B1B1 | 2 | B1 for yesB1 for clear diagram or explanation B1 for yesB1 for clear diagram or explanationB1 for yesB1 for clear diagram or explanationB1 for yesB1 for clear diagram or explanation | M |
| **8** |
| **68** | If cuboid has dimensions *x*, *y* and *t*The surface area = 2(*xy* + *xt* + *yt*)Volume = *xyt*Double the lengths gives dimensions as 2*x*, 2*y* and 2*t*So surface area = 2( 2*x* × 2*y* + 2*x* × 2*t* + 2*y* × 2*t*)= 2(4*xy* + 4*xt* + 4*yt*)= 8(*xy* + *xt* + *yt*)Which is 4 times the first areaAnd *V* = 2*x* × 2*y* × 2*t*= 8*xyt*which is 8 times the first volume. | False | B1M1M1M1B1B1B1B1 | 2 | B1 for falseM1 for surface area with either specific lengths or a generalisationM1 for volume with either specific lengths or a generalisationM1 for showing correct follow through of double the lengthsM1 for a correct statement of surface area with their dataB1 for 4 times areaB1 for a correct statement of volume with their dataB1 for 8 times volume | H |
| **8** |

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| **69** | Consider just half the shape, where *x* is a length of string.Use Pythagoras*x*2 = 102 + 22.52 = 606.25*x* =  = 24.622145Two lengths of string will be 49.244289 cmSubtract the original 45 cmGives extension as 4.244289 | 4.2 cm | M1M1M1A1A1A1 | 2 | M1 for clear diagram M1 for correct statement using Pythagoras’ theroemM1 for correct method of applying PythagorasA1 for full answerA1 for double the initial *x*A1 for rounded answer of either 2 or 3 sf | H |
| **6** |
| **70** | Let AC = *x*, the new length of road.Using Pythagoras*x*2 = 4.92 + 6.32 = 63.7*x* =  = 7.981228Current distance = 4.9 + 6.3 = 11.2 kmSaving = 11.2 – 7.981228= 3.218772 km | 3.22 km | M1M1M1A1B1M1A1 | 2 | M1 for use of a diagram to assist the explanationM1 for clear statement of Pythagoras’ theoremM1 for correctly applying Pythagoras’ theoremA1 for full answerB1 for 11.2M1 for subtracting lengthsA1 for correct rounding to 2 or 3 sf  | H |
| **7** |

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| **71** |  | Yes*ϴ* = sin–1  = 53.13= 53o to the nearest degree. = 50° to 1 sf12 cm has range of 11.5 cm to 12.5 cm15 cm has range of 14.5 cm to 15.5 cmSmallest ratio for sine is sin–1 0.7419, *ϴ* = 47.9°Largest ration for sine is sin–1 0.8621, *ϴ* = 59.5°So there are values that round to 12 cm and 15 cm which will give an angle that rounds to 50°. | B1M1M1B1B1 | 2 | B1 for yesM1 for showing that using trig and rounding can give 50°M1 for showing the ranges of lengths of the sidesB1 for showing the least possible value of the angle given the ranges.B1 for final summary explaining that it is possible | H |
| **5** |
| **72** | AB2 = 22 – 12= 4 – 1 = 3AB =  |  cm | M1A1M1 | 2 | M1 for correct statement of Pythagoras theoremA1 for 3M1 for a clear communication of the method used | H |
| **3** |
| **73** |  |   | B1B1 | 2 | B1 for correct diagramB1 for correct vector | H |
| **2** |
| **74** |  | NoTo work out the return vector, multiply each component by –1The return vector is  | B1B1B1 | 2 | B1 for noB1 for a clear explanation of what Joel should have done.B1 for correct vector | H |
| **3** |