Pearson Edexcel

Activity 5

For each of these example questions work through and decide:

(a) Is it a mathematical reasoning – in the sense defined in the PowerPoint?
(b) If so, what are the properties that make it a mathematical reasoning question?

(making deductions and drawing conclusions, constructing chains of reasoning, presenting arguments and proofs, interpreting and communicating information accurately)

Mark schemes for the questions are available in the following pages.

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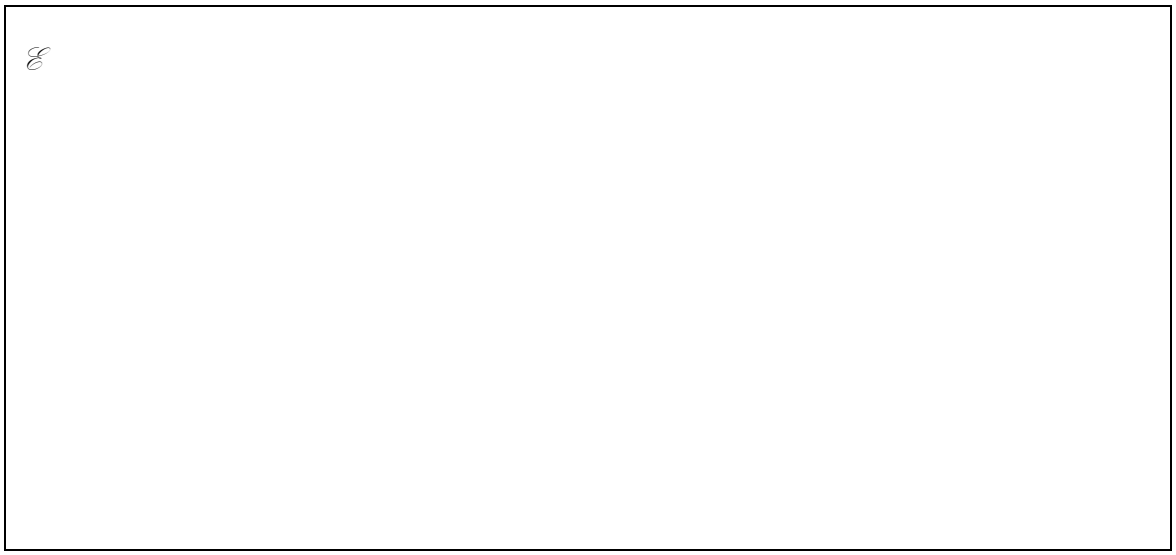
$\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$
$A = \{\text{odd numbers}\}$
$A \cap B = \{1, 3\}$
$A \cup B = \{1, 2, 3, 4, 5, 6, 7, 9, 11, 12\}$

Draw a Venn diagram to show this information.



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23 Solve the simultaneous equations

$$4x + 5y = 4$$
$$2x - y = 9$$

Show clear algebraic working.

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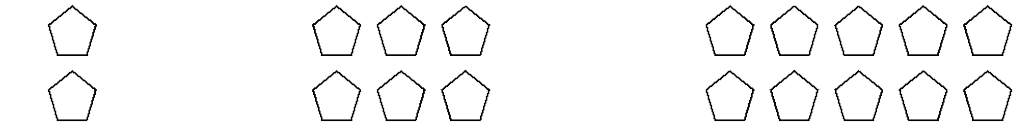
3 Here is a sequence of patterns made from identical pentagons.



Pattern number 1 **Pattern number 2** **Pattern number 3**

(*a*) (i) Work out the number of pentagons in Pattern number 4

.....

(ii) Explain how you worked out your answer.

.....

(2)

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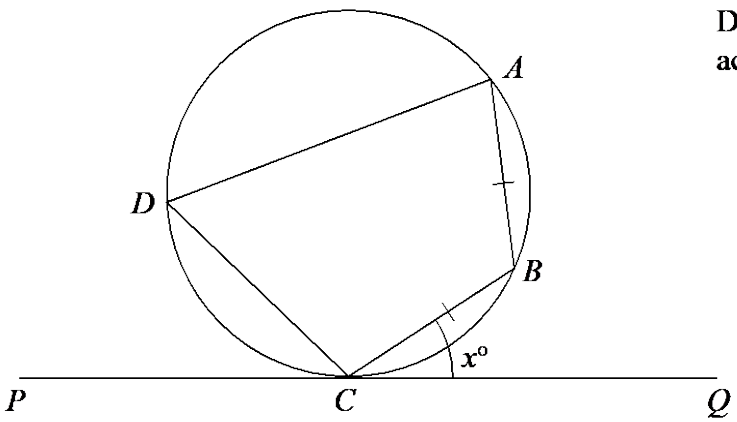

Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on a circle.
PCQ is a tangent to the circle.
AB = *CB*.

Angle *BCQ* = *x*°

Prove that angle *CDA* = 2*x*° Give reasons for each stage in your working.

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21 Line **L** has equation $4y - 6x = 33$
Line **M** goes through the point A (5, 6) and the point B (−4, k)

L is perpendicular to **M**.

Work out the value of k.

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Mark Schemes

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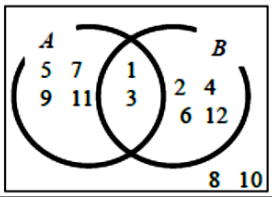
18		Fully correct Venn diagram	4	B4 fully correct Venn diagram with labels *A* and *B* (If not B4 then B3 for 3 correct regions, B2 for 2 correct regions B1 for 1 correct region)

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Question	Working	Answer	Mark	Notes	
23	e.g. $4x + 5y = 4$ $4x - 2y = 18$ with the operation of subtraction $4x + 5y = 4$ $10x - 5y = 45$ With the operation of adding $y = 2x - 9$ and $4x + 5(2x - 9) = 4$			M1	for correct method to eliminate one variable – multiplying one or both equations so the coefficient of x or y is the same in both with the intention to add or subtract to eliminate one variable(condone one arithmetic error) or isolating x or y in one equation and substituting into the other equation
				M1	(dep) for substitution of found variable into one equation or correct method to eliminate second variable
		$x = 3.5$ oe, $y = -2$	3	A1	dep on M1

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Question		Working	Answer	Mark	Notes	
3	(a)(i)		14	1	B1	
	(a)(ii)		Added 4	1	B1	Accept +4, 4 more, jumped forward by 4, difference = 4 or sight of $4n - 2$

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Question	Working	Answer	Mark	Notes
20	angle $CDB = x$ or angle $CAB = x$ angle $CBA = 180 - 2x$ angle $CDA = 180 - (180 - 2x) = 2x$			M1 M1 M1
		proof with reasons	5	B1 dep on M1 for any one appropriate circle theorem reason A1 for complete proof with full reasons alternate segment theorem, angles in a triangle sum to 180°, isosceles triangle, opposite angles of a cyclic quadrilateral sum to 180°
	Alternative method angle $CDB = x$ or angle $CAB = x$ angle $ACB = x$ angle $ACQ = 2x$ and angle $CDA = 2x$			M1 M1 M1
		proof with reasons	5	B1 dep on M1 for any one appropriate circle theorem reason A1 for complete proof with full reasons alternate segment theorem, isosceles triangle
	Alternative method angle $OCB = 90 - x$ angle $BOC = 180 - 2(90 - x)$ $(=2x)$ angle $AOB = 2x$ and angle $CDA = 2x$			M1 M1 M1
		proof with reasons	5	B1 dep for any one appropriate circle theorem reason A1 for complete proof with full reasons angle between tangent and radius is 90° oe, angles in a triangle sum to 180°, isosceles triangle, angle at centre is twice angle at circumference oe

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Q20 contd	**Alternative method where students assume $CDA = 2x$ and must work to show that $BCQ = x$**			
	eg angle ABC $= 180 - 2x$ Angle CAB = angle ACB = $[180 - (180 - 2x)] \div 2 = x$ $BCQ = CAB = x$			M1 M1 M1 B1 Dep on M1 for any one appropriate circle theorem reason A1 For complete proof with reasons e.g. opposite angles of cyclic quadrilateral sum to 180° angles in triangle sum to 180° isosceles triangle alternate segment theorem
21	$y = \frac{6}{4}x(+33)$ or (gradient $=$) $\frac{6}{4}$ oe $m \times \frac{6}{4} = -1$ or (gradient of M $=$) $-\frac{2}{3}$ oe $\frac{k-6}{-4-5} = "-\frac{2}{3}"$	12	4	M1 M1 M1 dep or complete method to find equation of line $(3y = -2x + 28)$ and then substitution of $x = -4$ A1