Hints online, answers free with an account:
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Grade 8/9 mixed revision 14

56 marks

Date

X Exam questions

Edexcel GCSE Higher style. Show all your working. The hints are at the end of the sheet. Use one at a time.

X1 Two curves have equations [3 marks]

$$y = x^2 + 4x - 5 \quad \text{and} \quad y = 11 - x^2$$

Find the coordinates of the points where the two curves meet.

Answer $(\ldots, \ldots)$ and $(\ldots, \ldots)$

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X2 The functions f, g and h are such that [3 marks]

$$f(x) = x + 2 \qquad g(x) = 3x \qquad h(x) = x^2$$

Solve $hgf(x) = 36$.

Answer $x = \ldots$

X3 A solution of $x^3 - 3x^2 - 2 = 0$ can be found using the iteration formula $x_{n+1} = 3 + \dfrac{2}{x_n^2}$ with $x_0 = 3$ [3 marks]

Use the formula until two values in a row are the same when rounded to 3 significant figures.
Hence write down the solution correct to 3 significant figures.

Answer $x = \ldots$

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X4 The line with equation $5x + 2y = 29$ is a tangent to a circle with centre $O(0, 0)$. [3 marks]

Find the radius of the circle.

Give your answer as a surd.

Answer ...

X5

(a) Show that $\frac{1}{x} + \frac{2}{x+1} - \frac{3}{x+2} = \frac{2(2x+1)}{x(x+1)(x+2)}$ [4 marks]

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(b) Hence solve $\frac{1}{x} + \frac{2}{x+1} - \frac{3}{x+2} = 0$ [1 mark]

Answer $x = \ldots$

Total for X5: 5 marks

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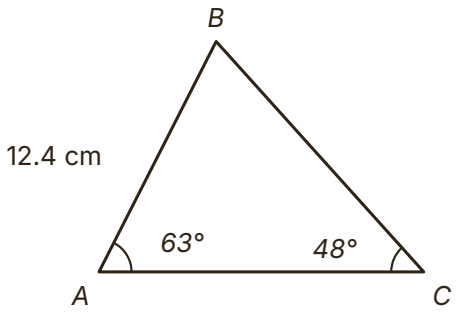
X6 In triangle ABC, [5 marks]

$AB = 12.4$ cm, correct to 1 decimal place,
angle $BAC = 63°$, correct to the nearest degree,
angle $ACB = 48°$, correct to the nearest degree.
Work out the upper bound for the length of BC.
Give your answer correct to 3 significant figures.
Diagram NOT accurately drawn



Answer $BC =$ ... cm

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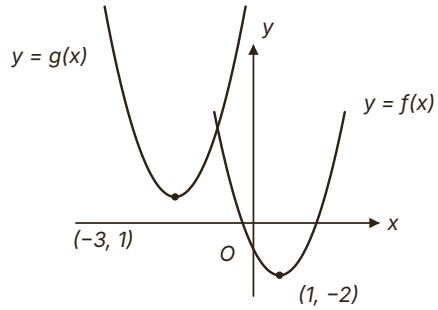
X7 The diagram shows sketches of the graphs of $y = f(x)$ and $y = g(x)$.
The graph of $y = f(x)$ has its turning point at $(1, -2)$.
The graph of $y = g(x)$ is a translation of the graph of $y = f(x)$, and has its turning point at $(-3, 1)$.



(a) $g(x) = f(x + a) + b$, where a and b are constants. [2 marks]
Find the value of a and the value of b.

Answer $a = \ldots$, $b = \ldots$

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(b) The graph of $y = f(x)$ is symmetrical about the vertical line through its turning point. [3 marks]

$f(5) = 14$

Find the two values of x for which $g(x) = 17$.

You must show your working.

Answer $x = \ldots$

Total for X7: 5 marks

X8 A square has an area of $(17 - 12\sqrt{2})$ cm².

The length of each side is $(a + b\sqrt{2})$ cm, where a and b are integers.

(a) Find the value of a and the value of b. [3 marks]

You must show all your working.

Answer $a = \ldots$, $b = \ldots$

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(b) A rectangle has the same area as the square. The width of the rectangle is $(\sqrt{2} - 1)$ cm. [2 marks]
Find the length of the rectangle. Give your answer in the form $p + q\sqrt{2}$, where p and q are integers.

Answer ... cm

Total for X8: 5 marks

X9 Sam wants to prove that the product of any two even numbers is a multiple of 8.
Here is his working.
Let the two even numbers be $2n$ and $2n + 2$.
$2n \times (2n + 2) = 4n^2 + 4n = 4n(n + 1)$
$n(n + 1)$ is even, so $4n(n + 1)$ is a multiple of 8.

(a) Give an example to show that the product of two even numbers is not always a multiple of 8. [1 mark]

(b) Explain what is wrong with Sam's method. [1 mark]

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(c) Sam writes "$n(n+1)$ is even" without a reason. [1 mark]
Explain why $n(n+1)$ is even for every integer n.

(d) Prove that the product of two consecutive even numbers is always 1 less than the square of an odd number. [3 marks]

Total for X9: 6 marks

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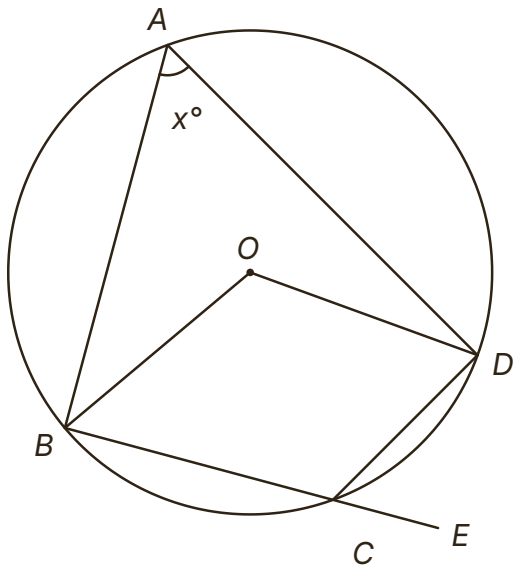
X10 A, B, C and D are points on a circle, centre O.
BCE is a straight line.
Angle $BAD = x^\circ$
Diagram NOT accurately drawn



(a) Prove that angle BAD + angle $BCD = 180^\circ$. [4 marks]
You may use the circle theorem about the angle at the centre.

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(b) Prove that angle $DCE =$ angle BAD. [2 marks]

Total for X10: 6 marks

X11 x is a number greater than 1.

(a) Show that the inequality [2 marks]

$$\frac{x+5}{2} > \frac{6}{x-1}$$

can be written as $x^2 + 4x - 17 > 0$

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(b) Hence solve $\frac{x+5}{2} > \frac{6}{x-1}$ for $x > 1$ [4 marks]

Give your answer in the form $x > a + \sqrt{b}$, where a and b are integers.

Answer $x > \ldots$

Total for X11: 6 marks

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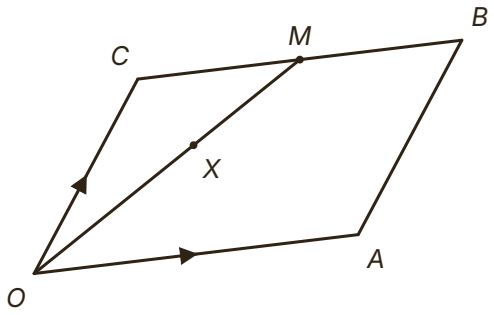
X12 $OABC$ is a parallelogram.

$\overrightarrow{OA} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$ and $\overrightarrow{OC} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$.

M is the midpoint of BC.

X is the point on OM such that $OX : XM = 2 : 1$.

Diagram NOT accurately drawn



(a) Find $\overrightarrow{OM}$ as a column vector. [2 marks]

Answer $\overrightarrow{OM} = \ldots$

(b) Find the length of OM. Give your answer in the form $k\sqrt{2}$, where k is an integer. [1 mark]

Answer ...

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(c) Prove that X lies on the diagonal AC. [3 marks]

Total for X12: 6 marks

F How did it go?

Colour one circle on each line.

	Not yet	Nearly	Yes
I can prove results with vectors, algebra and circle theorems, giving a reason for each step.	○	○	○
I can find tangents to circles and solve non-linear simultaneous equations and quadratic inequalities.	○	○	○
I can work with composite and inverse functions, algebraic fractions, surds and transformations of graphs.	○	○	○
I can use bounds with division and subtraction, and find roots by iteration.	○	○	○

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Hints

Use one hint at a time. Cover the ones below it with a sheet of paper.

X1

Hint 1 At the points where the curves meet, both equations give the same y. Set the right-hand sides equal.

Hint 2 Collect everything on one side: $2x^2 + 4x - 16 = 0$, then divide by 2.

Hint 3 Factorise $x^2 + 2x - 8$. Substitute each x into either equation to find y.

X2

Hint 1 $hgf(x)$ means do f first, then g, then h.

Hint 2 $gf(x) = 3x + 6$, so $hgf(x) = (3x + 6)^2$.

Hint 3 Square root both sides of $(3x + 6)^2 = 36$: $3x + 6 = 6$ or $3x + 6 = -6$.

X3

Hint 1 Find x_1, x_2, x_3, ... in turn and round each one to 3 significant figures as you go.

Hint 2 $x_1 = 3.2222\ldots$ and $x_2 = 3.1926\ldots$ round to different values, so keep going.

Hint 3 x_3 and x_4 round to the same value. Write that value to 3 significant figures; a final zero is a significant figure.

X4

Hint 1 The radius to the point where the tangent touches is perpendicular to the tangent, and it passes through O.

Hint 2 The tangent has gradient $-\frac{5}{2}$, so the radius lies on $y = \frac{2}{5}x$. Find where this meets $5x + 2y = 29$.

Hint 3 The point of contact is $(5, 2)$. The radius is its distance from O.

X5

Hint 1 The common denominator is $x(x + 1)(x + 2)$.

Hint 2 Each numerator is multiplied by the two brackets its own denominator is missing: $(x + 1)(x + 2) + 2x(x + 2) - 3x(x + 1)$.

Hint 3 The x^2 terms cancel and the numerator is $4x + 2$. For (b), a fraction is 0 only when its numerator is 0.

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X6

Hint 1 Write down the bounds of AB and of both angles. Each angle is to the nearest degree.

Hint 2 Use the sine rule to write BC in terms of AB, $\sin A$ and $\sin C$.

Hint 3 For the largest BC, make the top of $\dfrac{AB \sin A}{\sin C}$ large and the bottom small: use $AB = 12.45$, $A = 63.5°$ and $C = 47.5°$.

X7

Hint 1 Compare the turning points: how far across and how far up does $(1, -2)$ move to reach $(-3, 1)$?

Hint 2 Moving left by 4 means $f(x + 4)$, not $f(x - 4)$. For (b), write $g(x) = 17$ in terms of f.

Hint 3 $f(x + 4) = 14$. You know $f(5) = 14$; the point the same distance from $x = 1$ on the other side also gives 14. Set $x + 4$ equal to each of the two values.

X8

Hint 1 Expand $(a + b\sqrt{2})^2$ and compare it with $17 - 12\sqrt{2}$.

Hint 2 The whole number parts give $a^2 + 2b^2 = 17$ and the $\sqrt{2}$ parts give $2ab = -12$. A length must be positive.

Hint 3 Look for two integers with product -6 that give $a^2 + 2b^2 = 17$, and choose the signs so that the length is positive. For (b), length $=$ area $\div$ width: multiply the top and the bottom by $\sqrt{2} + 1$.

X9

Hint 1 For part (a), try two small even numbers that are not next to each other.

Hint 2 For part (b), look at how Sam chose the two even numbers. For part (d), expand $2n(2n + 2)$.

Hint 3 $4n^2 + 4n$ is one less than $4n^2 + 4n + 1$. Write $4n^2 + 4n + 1$ as a square.

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X10

Hint 1 Angle BAD and the angle BOD at the centre stand on the same arc BD.

Hint 2 The other angle at O is the reflex angle BOD. Angle BCD stands on the same arc as this reflex angle.

Hint 3 Reflex angle $BOD = 360 - 2x$, so angle BCD is half of it. For part (b), use angles on the straight line BCE.

X11

Hint 1 Because $x > 1$, the denominator $x - 1$ is positive, so you can multiply by it without changing the sign.

Hint 2 For part (b), find the critical values of $x^2 + 4x - 17$ by completing the square.

Hint 3 $(x + 2)^2 = 21$ gives $x = -2 \pm \sqrt{21}$. The quadratic is positive outside these values; now use $x > 1$ to decide which part to keep.

X12

Hint 1 In a parallelogram $\overrightarrow{CB} = \overrightarrow{OA}$. Go from O to C, then half way along CB.

Hint 2 The length of a column vector $\begin{pmatrix} p \\ q \end{pmatrix}$ is $\sqrt{p^2 + q^2}$. For part (c), $\overrightarrow{OX} = \frac{2}{3}\overrightarrow{OM}$.

Hint 3 Work out $\overrightarrow{AX} = \overrightarrow{OX} - \overrightarrow{OA}$ and $\overrightarrow{AC} = \overrightarrow{OC} - \overrightarrow{OA}$. Show that $\overrightarrow{AX}$ is a fraction of $\overrightarrow{AC}$, and say which point they share.

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