Hints online, answers free with an account:
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Grade 8/9 mixed revision 3

55 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 Solve $3x^2 + 5x - 12 \leqslant 0$ [3 marks]

Give your answer as an inequality.

Answer .....

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X2 The function f is defined by [3 marks]

$$f(x) = \frac{3x - 1}{x + 2} \qquad x \neq -2$$

Solve $f^{-1}(x) = 5$.

Answer $x = \ldots$

X3 Jamal measures a rectangle. Its length is 8 cm and its width is 5 cm, each correct to the nearest centimetre. [4 marks]
He works out the area as 40 cm².
Work out the greatest possible difference between Jamal's value and the actual area, as a percentage of Jamal's value.
Give your answer correct to 3 significant figures.

Answer $\ldots$ %

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X4 The iteration formula $x_{n+1} = \dfrac{6}{x_n + 2}$ is used with $x_0 = 1$

(a) Find the value of x_3 [2 marks]

Give your answer correct to 4 decimal places.

Answer $x_3 = \ldots$

(b) The values of x_n get closer to a number L. [2 marks]

Find the exact value of L. Give your answer in the form $a + \sqrt{b}$, where a and b are integers.

Answer $L = \ldots$

Total for X4: 4 marks

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X5 Curve C_1 has equation $y = x^2 - 4x + 7$. [4 marks]
Curve C_2 has equation $y = x^2 + 6x + 16$.
Describe fully the single transformation that maps C_1 onto C_2.

Answer ...

X6 Write [4 marks]

$$\frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{5}} + \cdots + \frac{1}{\sqrt{24}+\sqrt{25}}$$

in the form $a + b\sqrt{2}$, where a and b are integers.
You must show all your working.

Answer ...

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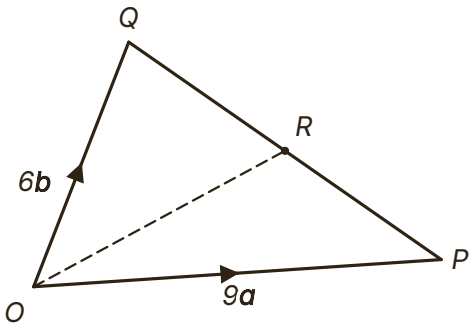
X7 OPQ is a triangle.

$\overrightarrow{OP} = 9\mathbf{a}$ and $\overrightarrow{OQ} = 6\mathbf{b}$.

R is a point on PQ such that $\overrightarrow{OR} = 3\mathbf{a} + k\mathbf{b}$, where k is a constant.

Diagram NOT accurately drawn



(a) Find $\overrightarrow{PQ}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. [1 mark]

Answer $\overrightarrow{PQ} = \ldots$

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

You must show all your working.

Answer $k = \ldots$

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(c) Find the ratio $PR : RQ$. [1 mark]

Answer ⋯ : ⋯

Total for X7: 5 marks

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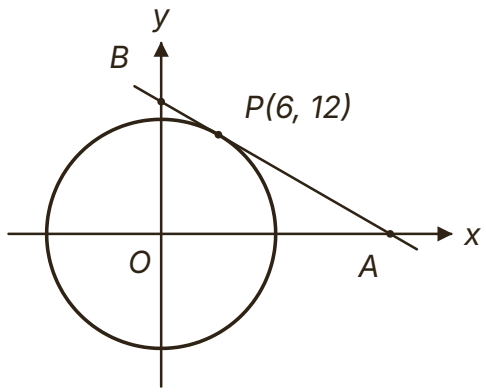
X8 The point $P(6, 12)$ lies on the circle with equation $x^2 + y^2 = 180$. [5 marks]
The tangent to the circle at P meets the x-axis at A and the y-axis at B.
Find the area of triangle OAB, where O is the origin.
Diagram NOT accurately drawn



Answer ... square units

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X9 $f(x) = 3x^2 + 18x + 31$

(a) Write $f(x)$ in the form $a(x + b)^2 + c$, where a, b and c are integers. [3 marks]

Answer ...

(b) Hence prove that $f(x) > 0$ for all values of x, and write down the least value of $f(x)$. [2 marks]

Total for X9: 5 marks

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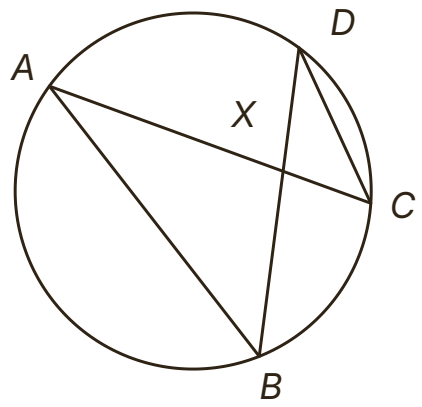
X10 A, B, C and D are points on a circle.
The chords AC and BD meet at the point X.
Diagram NOT accurately drawn



(a) Prove that triangle ABX and triangle DCX are similar. [3 marks]

(b) $AX = 8$ cm, $XC = 3$ cm and $BX = 6$ cm. [2 marks]
Work out the length of XD.

Answer $XD = \ldots$ cm

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(c) $AB = 11$ cm. [1 mark]

Work out the length of CD.

Answer $CD = \ldots$ cm

Total for X10: 6 marks

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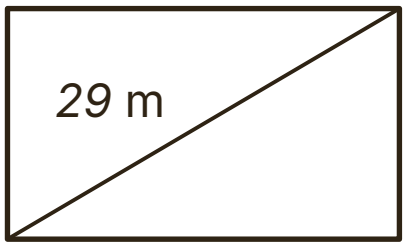
X11 A rectangular field has a perimeter of 82 m. [6 marks]
The diagonal of the field is 29 m long.
Work out the area of the field.
You must show all your working.
Diagram NOT accurately drawn



Answer ... m^2

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X12 Mia cycles 36 km at an average speed of x km/h.
She then cycles a further 30 km at an average speed of $(x + 3)$ km/h.
Her total time for the 66 km is 5 hours.

(a) Show that $5x^2 - 51x - 108 = 0$ [3 marks]

(b) Work out Mia's average speed for the first 36 km. [3 marks]
You must show all your working.

Answer ... km/h

Total for X12: 6 marks

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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**	Find the critical values by solving $3x^2 + 5x - 12 = 0$.
	Hint 2	$3x^2 + 5x - 12$ factorises as $(3x - 4)(x + 3)$.
	Hint 3	The critical values are -3 and $\frac{4}{3}$. The graph is below the x-axis between them, and the inequality includes the end points.
X2	**Hint 1**	$f^{-1}(x) = 5$ means that f takes the number 5 to x.
	Hint 2	So $x = f(5)$. (You can also find $f^{-1}(x)$ first and set it equal to 5.)
	Hint 3	$f(5) = \dfrac{3 \times 5 - 1}{5 + 2}$. Simplify this fraction.
X3	**Hint 1**	Write down the bounds of the length and of the width.
	Hint 2	Work out the largest and the smallest possible areas. The two differences from 40 are not the same size.
	Hint 3	The largest area is 8.5×5.5. Find how far it is from 40 and write this as a percentage of 40.
X4	**Hint 1**	For part (a), put $x_0 = 1$ into the formula, then use each answer to find the next value.
	Hint 2	For part (b), when the values settle, x_{n+1} and x_n are both equal to L. Write $L = \dfrac{6}{L + 2}$.
	Hint 3	Multiply out to get $L^2 + 2L - 6 = 0$ and complete the square. The values x_n are all positive, so choose the positive solution.
X5	**Hint 1**	Complete the square for each equation to find each turning point.
	Hint 2	C_1: $(x - 2)^2 + 3$. Do the same for $x^2 + 6x + 16$.
	Hint 3	The turning points are $(2, 3)$ and $(-3, 7)$. Work out how far across and how far up you move from the first to the second, and write it as a column vector. Say the word "translation".

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X6

Hint 1 Rationalise the first term, $\dfrac{1}{\sqrt{2}+\sqrt{3}}$, by multiplying the top and the bottom by $\sqrt{3}-\sqrt{2}$.

Hint 2 Every term has the same shape, and every denominator becomes 1. Write the first few terms out after rationalising.

Hint 3 The sum is $(\sqrt{3}-\sqrt{2})+(\sqrt{4}-\sqrt{3})+\cdots+(\sqrt{25}-\sqrt{24})$. Look at what cancels and what is left.

X7

Hint 1 $\overrightarrow{PQ}=\overrightarrow{PO}+\overrightarrow{OQ}$.

Hint 2 Because R lies on PQ, write $\overrightarrow{OR}=\overrightarrow{OP}+\lambda\,\overrightarrow{PQ}$ and collect the $\mathbf{a}$ terms and the $\mathbf{b}$ terms.

Hint 3 Set the coefficient of $\mathbf{a}$ equal to 3 to find λ, then put λ into the coefficient of $\mathbf{b}$. The fraction λ also tells you how far along PQ the point R is.

X8

Hint 1 Find the gradient of the radius OP, then the gradient of the tangent, which is perpendicular to OP.

Hint 2 Write the equation of the tangent through $P(6,12)$. Then put $y=0$ to find A and $x=0$ to find B.

Hint 3 The tangent is $y=-\dfrac{1}{2}x+15$. Triangle OAB has a right angle at O, so its area is $\dfrac{1}{2}\times OA\times OB$.

X9

Hint 1 Take the 3 out of the first two terms: $3(x^2+6x)+31$.

Hint 2 $x^2+6x=(x+3)^2-9$. Multiply the -9 by 3 as well.

Hint 3 You should get $3(x+3)^2+c$. A square is never negative, so the least value happens when $x+3=0$.

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X10

Hint 1 Look for two angles in triangle ABX that stand on the same arc as two angles in triangle DCX.

Hint 2 Angle BAC and angle BDC both stand on the arc BC. Angle ABD and angle ACD both stand on the arc AD.

Hint 3 Match the sides that are opposite equal angles: AX goes with DX, BX goes with CX, and AB goes with DC. Then use the scale factor.

X11

Hint 1 Call the length x and the width y. Write one equation from the perimeter and one from the diagonal using Pythagoras.

Hint 2 The equations are $x + y = 41$ and $x^2 + y^2 = 841$. Substitute $y = 41 - x$ into the second one.

Hint 3 You get $x^2 - 41x + 420 = 0$. Solve it to find the length and width, then multiply them.

X12

Hint 1 Use time $=$ distance $\div$ speed for each part of the journey and add the two times.

Hint 2 $\dfrac{36}{x} + \dfrac{30}{x+3} = 5$. Multiply every term by $x(x+3)$.

Hint 3 For (b), factorise $5x^2 - 51x - 108$ as $(5x + 9)(x - 12)$ and decide which solution can be a speed.

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