Hints online, answers free with an account:
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Grade 8/9 mixed revision 15

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 One number is 3 more than another number. [3 marks]
The sum of the squares of the two numbers is 89.
Find the two possible pairs of numbers.

Answer ... and ... , or ... and ...

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X2 $ABCD$ is a quadrilateral. [4 marks]

Angle $DAB = (4x - 20)^\circ$

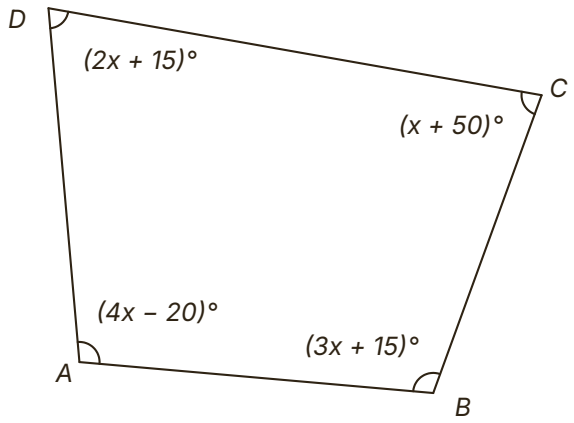
Angle $ABC = (3x + 15)^\circ$

Angle $BCD = (x + 50)^\circ$

Angle $CDA = (2x + 15)^\circ$

Prove that A, B, C and D lie on a circle.

Diagram NOT accurately drawn



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X3

$$E = \frac{2x^2 - 8}{x^2 + 3x - 10}$$

(a) Simplify E fully. [3 marks]

Answer $E = \ldots$

(b) Hence find the value of E when $x = 98$. [1 mark]
Give your answer as a fraction in its simplest form.

Answer .....

Total for X3: 4 marks

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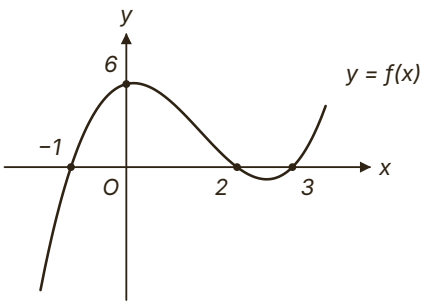
X4 The diagram shows a sketch of the graph of $y = f(x)$, where

$$f(x) = (x + 1)(x - 2)(x - 3) = x^3 - 4x^2 + x + 6.$$



(a) The graph of $y = f(x)$ is reflected in the x-axis. [1 mark]
Write down the equation of the new graph in the form $y = ax^3 + bx^2 + cx + d$.

Answer $y = \ldots$

(b) The graph of $y = f(x)$ is reflected in the y-axis. [2 marks]
Find the equation of the new graph in the form $y = ax^3 + bx^2 + cx + d$.

Answer $y = \ldots$

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(c) Write down the coordinates of the points where the graph in part (b) crosses the x-axis. [1 mark]

Answer ...

Total for X4: 4 marks

X5 [4 marks]

Write $\dfrac{2-\dfrac{1}{\sqrt{3}}}{2+\dfrac{1}{\sqrt{3}}}$ in the form $\dfrac{a+b\sqrt{3}}{c}$, where a, b and c are integers.

You must show all your working.

Answer ...

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X6 How many integer values of n satisfy $3n^2 \leqslant 7n + 40$? [5 marks]
You must show all your working.

Answer .....

X7 The functions f and g are such that

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

The function h is defined by $h(x) = gf(x)$ for $x \geqslant 3$.

(a) Find $h(x)$. [1 mark]

Answer $h(x) = \ldots$

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(b) Find $h^{-1}(x)$. [3 marks]

Answer $h^{-1}(x) = \ldots$

(c) Work out $h^{-1}(50)$. [1 mark]

Answer .....

Total for X7: 5 marks

X8 The curve $y = x^3 + 1$ and the line $y = 5x$ meet at three points.

(a) Show that the x-coordinates of the points satisfy $x^3 - 5x + 1 = 0$ [1 mark]

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(b) Show that one of the points has an x-coordinate between 2 and 3. [2 marks]

(c) Use the iteration formula $x_{n+1} = \sqrt[3]{5x_n - 1}$ with $x_0 = 2$ to find the value of x_3
Give your answer correct to 3 decimal places. [2 marks]

Answer $x_3 = \ldots$

Total for X8: 5 marks

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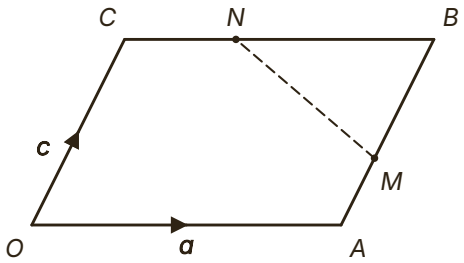
X9 $OABC$ is a parallelogram.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

M is the point on AB such that $AM : MB = 1 : 2$.

N is the point on CB such that $CN : NB = 1 : 2$.

Diagram NOT accurately drawn



(a) Find $\overrightarrow{MN}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. Give your answer in its simplest form. [3 marks]

Answer $\overrightarrow{MN} = \ldots$

(b) Show that MN is parallel to AC, and find the ratio $MN : AC$ [2 marks]

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Total for X9: 5 marks

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X10 The nth term of a sequence is $4n + 1$.

(a) Prove that the product of any two terms of the sequence is also a term of the sequence. [3 marks]

(b) Prove that the sum of any two terms of the sequence is never a term of the sequence. [2 marks]

Total for X10: 5 marks

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X11 A tank is a cuboid. It is 1.6 m long, 1.2 m wide and 0.9 m deep. Each length is correct to 1 decimal place.
The tank is empty. Water flows into the tank at 40 litres per minute, correct to the nearest litre per minute.
$1\ \text{m}^3 = 1000$ litres.

(a) Show that the tank will definitely be full within 50 minutes. [4 marks]

(b) Could the tank be full in less than 40 minutes? You must show how you get your answer. [2 marks]

Total for X11: 6 marks

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X12 The point $P(a, b)$ lies on the circle with equation $x^2 + y^2 = r^2$, where $a \neq 0$ and $b \neq 0$.

(a) Prove that the tangent to the circle at P has equation $ax + by = r^2$. [3 marks]

(b) The points A and B lie on the circle with equation $x^2 + y^2 = 26$. Both A and B have x-coordinate 1.
The tangents to the circle at A and at B meet at the point T.
Find the coordinates of T. [3 marks]

Answer $(\ldots, \ldots)$

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**	Call the smaller number n. Then the other number is $n + 3$.
	Hint 2	Write an equation for the sum of the squares and rearrange it to a quadratic equal to 0.
	Hint 3	$n^2 + 3n - 40 = 0$ has two solutions, and each one gives a pair. Do not leave out the negative pair.
X2	**Hint 1**	What do the angles of any quadrilateral add up to? Form an equation in x.
	Hint 2	Solve $10x + 60 = 360$, then work out all four angles.
	Hint 3	A quadrilateral is cyclic when its opposite angles add up to 180°. Check angle DAB + angle BCD and angle ABC + angle CDA.
X3	**Hint 1**	Take out the common factor 2 from $2x^2 - 8$ first; what is left is a difference of two squares.
	Hint 2	Factorise $x^2 + 3x - 10$ with two numbers that multiply to -10 and add to 3.
	Hint 3	Cancel the common bracket $(x - 2)$. For (b), put $x = 98$ into the simplified form.
X4	**Hint 1**	A reflection in the x-axis is $y = -f(x)$; a reflection in the y-axis is $y = f(-x)$.
	Hint 2	For (b), replace every x by $(-x)$. An odd power of $(-x)$ is negative and an even power is positive.
	Hint 3	$(-x)^3 = -x^3$ and $(-x)^2 = x^2$. For (c), a reflection in the y-axis changes the sign of each x-coordinate where the graph meets the axis.

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X5

Hint 1 Multiply the top and the bottom of the large fraction by $\sqrt{3}$ to remove the small fractions.

Hint 2 You get $\dfrac{2\sqrt{3}-1}{2\sqrt{3}+1}$. Now multiply the top and the bottom by $2\sqrt{3}-1$.

Hint 3 The denominator is $(2\sqrt{3})^2 - 1 = 11$. Expand $(2\sqrt{3}-1)^2$; remember $(2\sqrt{3})^2 = 12$.

X6

Hint 1 Rearrange so that one side is 0, then find the critical values.

Hint 2 $3n^2 - 7n - 40$ factorises as $(3n+8)(n-5)$.

Hint 3 The inequality holds for $-\frac{8}{3} \leqslant n \leqslant 5$. List the integers in this range, including 5, and count them.

X7

Hint 1 $h(x) = gf(x)$: put $f(x)$ into g.

Hint 2 Write $y = 2(x-3)^2$, divide both sides by 2 and then take the square root.

Hint 3 Because $x \geqslant 3$, $x - 3$ is not negative, so take only the positive square root, then add 3. For (c), put 50 into your answer to (b).

X8

Hint 1 Where the curve and the line meet, the two y values are equal.

Hint 2 For part (b), substitute $x = 2$ and $x = 3$ into $x^3 - 5x + 1$ and compare the signs.

Hint 3 For part (c), $x_1 = \sqrt[3]{5 \times 2 - 1} = \sqrt[3]{9}$. Keep going with the unrounded values and round x_3 at the end.

X9

Hint 1 In a parallelogram $\overrightarrow{AB} = \overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CB} = \overrightarrow{OA} = \mathbf{a}$.

Hint 2 M is one third of the way from A to B, so $\overrightarrow{OM} = \mathbf{a} + \frac{1}{3}\mathbf{c}$. Find $\overrightarrow{ON}$ the same way.

Hint 3 $\overrightarrow{MN} = \overrightarrow{ON} - \overrightarrow{OM}$. Take out the common factor and compare with $\overrightarrow{AC} = \mathbf{c} - \mathbf{a}$.

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X10

Hint 1 Use two different letters for two terms: $4a + 1$ and $4b + 1$.

Hint 2 Expand the product. To show it is a term, write it as $4(\dots) + 1$.

Hint 3 $16ab + 4a + 4b + 1 = 4(4ab + a + b) + 1$. For part (b), add the two terms and write the sum as $4(\dots) + 2$.

X11

Hint 1 Write down the bounds of the three lengths and of the rate. Volume is length times width times depth.

Hint 2 Time is volume divided by rate. The greatest time uses the greatest volume and the least rate; the least time uses the opposite.

Hint 3 For (a) work out $1.65 \times 1.25 \times 0.95 \times 1000 \div 39.5$. For (b) use 1.55, 1.15, 0.85 and 40.5.

X12

Hint 1 For (a), the tangent at P is perpendicular to OP, which has gradient $\dfrac{b}{a}$.

Hint 2 Write $y - b = -\dfrac{a}{b}(x - a)$, multiply by b and use the fact that P lies on the circle.

Hint 3 For (b), $1 + y^2 = 26$ gives two points. Use the result of (a) for each tangent and solve the pair of equations.

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