Hints online, answers free with an account:
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Grade 8/9 mixed revision 2

47 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 Prove that the difference between the squares of any two consecutive odd numbers is a multiple of 8. [3 marks]

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X2 Solve the simultaneous equations [3 marks]

$$y = 3x^2 + 2x - 5$$

$$y = 4x + 3$$

Answer $x = \ldots, y = \ldots$ or $x = \ldots, y = \ldots$

X3 Simplify fully $\dfrac{3x^2 - 10x - 8}{x^2 - 2x - 8}$ [3 marks]

Answer .....

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X4 A plank of wood is 3.4 m long, correct to the nearest 10 cm. [3 marks]
A piece of length 185 cm, correct to the nearest cm, is cut from the plank.
Work out the lower bound for the length of the plank that is left.
Give your answer in metres.

Answer ... m

X5 Show that $2x^3 = 3x + 4$ has a solution between $x = 1$ and $x = 2$. [3 marks]

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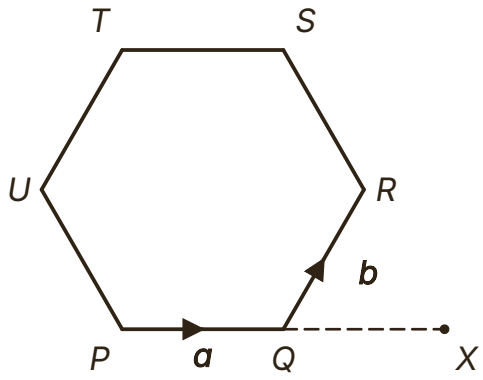
X6 $PQRSTU$ is a regular hexagon. [3 marks]

$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{QR} = \mathbf{b}$.

The side PQ is extended to the point X so that $QX = PQ$.

Prove that S, R and X lie on a straight line.



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X7 A and B are points on a circle, centre O. [4 marks]

TA and TB are tangents to the circle.

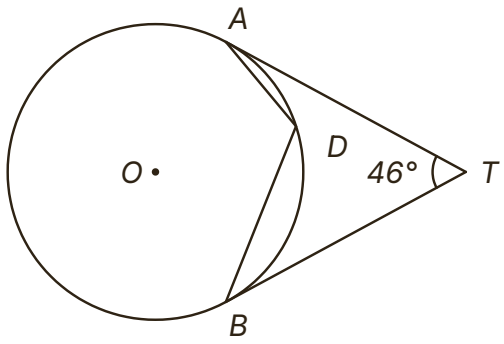
D is a point on the minor arc AB.

Angle $ATB = 46°$

Work out the size of angle ADB.

Give a reason for each stage of your working.

Diagram NOT accurately drawn



Answer Angle $ADB = \ldots°$

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X8 The point $P(a, -3)$ lies on the circle with equation $x^2 + y^2 = 58$, where $a > 0$.

(a) Find the value of a. [1 mark]

Answer $a = \ldots$

(b) Find an equation of the tangent to the circle at P. [3 marks]
Give your answer in the form $px + qy = r$, where p, q and r are integers.

Answer .....

Total for X8: 4 marks

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X9 Find all the integer values of x that satisfy both [5 marks]

$$2x^2 - 9x - 18 < 0 \quad \text{and} \quad 4 - 3x > x - 12$$

You must show all your working.

Answer .....

X10 The function f is defined by

$$f(x) = x^2 + 2x \qquad x \geqslant -1$$

(a) Find $f^{-1}(x)$. [3 marks]

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

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(b) Solve $f(x) = f^{-1}(x)$. [2 marks]

Answer $x = \ldots$

Total for X10: 5 marks

X11 p and q are integers such that [5 marks]

$$(p + q\sqrt{3})(2 - \sqrt{3}) = 1 + 5\sqrt{3}$$

Find the value of p and the value of q.
You must show all your working.

Answer $p = \ldots$, $q = \ldots$

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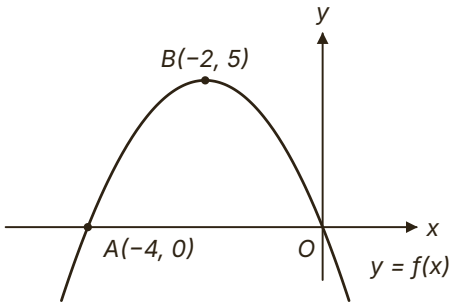
X12 The diagram shows a sketch of the graph of $y = f(x)$.
The graph crosses the x-axis at O and at $A(-4, 0)$, and has a maximum point at $B(-2, 5)$.



(a) The graph of $y = f(x + 3)$ is drawn. [2 marks]
Write down the coordinates of its maximum point and of the points where it crosses the x-axis.

Answer max $(\ldots, \ldots)$; $(\ldots, 0)$, $(\ldots, 0)$

(b) Write down the coordinates of the turning point of the graph of $y = 3 - f(x)$, and state whether it is a maximum or a minimum. [2 marks]

Answer $(\ldots, \ldots)$, ...

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(c) Find the coordinates of the images of A and of B on the graph of $y = f(-x) + 2$. [2 marks]

Answer $A \to (\ldots, \ldots)$, $B \to (\ldots, \ldots)$

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**	Two consecutive odd numbers differ by 2. Write them using one letter, for example $2n-1$ and $2n+1$.
	Hint 2	Expand $(2n+1)^2$ and $(2n-1)^2$. Take care with the sign of the middle term.
	Hint 3	When you subtract, the $4n^2$ and the 1 cancel. Write what is left as $8\times$ an integer.
X2	**Hint 1**	Both equations give y, so set $3x^2+2x-5$ equal to $4x+3$.
	Hint 2	Rearrange to a quadratic equal to 0: $3x^2-2x-8=0$.
	Hint 3	Factorise as $(3x+4)(x-2)=0$. Use $y=4x+3$ to find the y value for each x.
X3	**Hint 1**	Factorise the numerator and the denominator separately.
	Hint 2	For $3x^2-10x-8$, look for two numbers that multiply to $3\times(-8)=-24$ and add to -10.
	Hint 3	$3x^2-10x-8=(3x+2)(x-4)$ and $x^2-2x-8=(x-4)(x+2)$. Cancel the common bracket.
X4	**Hint 1**	Change both lengths to metres and write down the bounds of each one.
	Hint 2	For the smallest amount left, start with the smallest plank and take away the largest piece.
	Hint 3	The plank is at least 3.35 m and the piece is less than 1.855 m.
X5	**Hint 1**	A change of sign only shows a solution when one side of the equation is 0. Rearrange first.
	Hint 2	Write the equation as $2x^3-3x-4=0$ and work out the left-hand side when $x=1$ and when $x=2$.
	Hint 3	You should get -5 and 6. Say that one is negative and one is positive, so there is a change of sign.

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X6

Hint 1 The long diagonal PS of a regular hexagon is parallel to QR and twice its length.

Hint 2 Find $\overrightarrow{RS}$ by going $R \to P \to S$, and find $\overrightarrow{RX}$ by going $R \to Q \to X$. Note $\overrightarrow{QX} = \mathbf{a}$.

Hint 3 $\overrightarrow{RS} = \mathbf{b} - \mathbf{a}$ and $\overrightarrow{RX} = \mathbf{a} - \mathbf{b}$. Say what one is as a multiple of the other, and name the point they share.

X7

Hint 1 Join OA and OB. What angle does a tangent make with a radius?

Hint 2 Use the angles in the quadrilateral $OATB$ to find angle AOB.

Hint 3 D is on the minor arc, so angle ADB is half of the reflex angle AOB, not half of angle AOB.

X8

Hint 1 For (a), substitute $y = -3$ into $x^2 + y^2 = 58$. The square root has two values; use the condition $a > 0$.

Hint 2 For (b), the gradient of OP is $\dfrac{-3}{7}$. The tangent is perpendicular to OP.

Hint 3 Use $y + 3 = \dfrac{7}{3}(x - 7)$, multiply both sides by 3 and collect the x and y terms on one side.

X9

Hint 1 Solve each inequality on its own first, then find the values that work in both.

Hint 2 Factorise $2x^2 - 9x - 18$ to find its critical values. For the linear one, collect the x terms on the side where they are positive.

Hint 3 The quadratic gives $-\frac{3}{2} < x < 6$ and the linear one gives $x < 4$. List the integers that are in both ranges.

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X10

Hint 1 Complete the square: $x^2 + 2x = (x+1)^2 - 1$.

Hint 2 Write $y = (x+1)^2 - 1$ and make x the subject. Take the positive square root because $x \geqslant -1$.

Hint 3 For (b): the graph of $y = f^{-1}(x)$ is the reflection of $y = f(x)$ in $y = x$, and here f is increasing, so they meet where $f(x) = x$. Solve $x^2 + 2x = x$.

X11

Hint 1 Either divide both sides by $2 - \sqrt{3}$, or expand the left-hand side.

Hint 2 If you divide, rationalise $\dfrac{1 + 5\sqrt{3}}{2 - \sqrt{3}}$ by multiplying the top and the bottom by $2 + \sqrt{3}$.

Hint 3 The denominator becomes 1. Expand $(1 + 5\sqrt{3})(2 + \sqrt{3})$; the whole number part is p and the number of $\sqrt{3}$ is q.

X12

Hint 1 Inside the bracket ($x + a$ or $-x$) changes the x-coordinates; outside ($+$ or $-$ a number, or a minus sign in front of f) changes the y-coordinates.

Hint 2 $f(x + 3)$ moves every point 3 to the left. $-f(x)$ changes the sign of every y-coordinate, so a maximum turns into a minimum. $f(-x)$ changes the sign of every x-coordinate.

Hint 3 For (b), take $B(-2, 5)$ to $(-2, -5)$ and then add 3 to the y-coordinate. For (c), change the sign of the x-coordinate and then add 2 to the y-coordinate.

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