Hints online, answers free with an account:
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Grade 8/9 mixed revision 7

54 marks

Date

X Exam questions

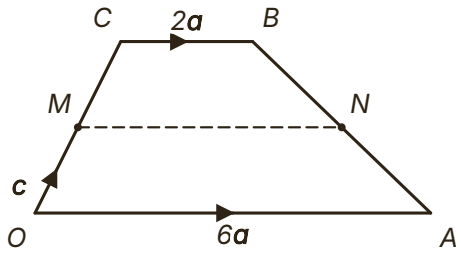
Edexcel GCSE Higher style. Show all your working. The hints are at the end of the sheet. Use one at a time.

X1 $OABC$ is a trapezium with OA parallel to CB. [3 marks]

$\overrightarrow{OA} = 6\mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CB} = 2\mathbf{a}$.

M is the midpoint of OC and N is the midpoint of AB.

Show that MN is parallel to OA, and find the ratio $MN : OA$.



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X2 Write $\dfrac{4}{x+2} - \dfrac{x-18}{x^2-x-6}$ as a single fraction in its simplest form. [4 marks]

Answer .....

X3 $f(x) = x^2 + 8x + 19$

(a) Write $f(x)$ in the form $(x+p)^2 + q$. [2 marks]

Answer ...

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(b) Write down the coordinates of the turning point of the graph of $y = -f(x)$, and state whether it is a maximum or a minimum. [1 mark]

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

(c) Write down the coordinates of the turning point of the graph of $y = f(-x)$. [1 mark]

Answer $(\ldots, \ldots)$

Total for X3: 4 marks

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X4 Write $\dfrac{(3-2\sqrt{5})(4+\sqrt{5})}{2+\sqrt{5}}$ in the form $a+b\sqrt{5}$, where a and b are integers. [4 marks]

You must show all your working.

Answer ...

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X5 The circle C has equation $x^2 + y^2 = 17$ and centre O. [4 marks]

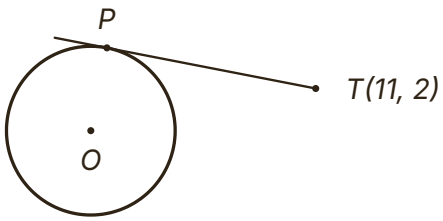
The point T has coordinates $(11, 2)$.

A straight line from T touches C at the point P.

Find the length of TP.

Give your answer in the form $a\sqrt{3}$, where a is an integer.

Diagram NOT accurately drawn



Answer $TP = \ldots$

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X6 The curve C has equation $y = x^2 + x - 4$. [4 marks]
The line L has equation $y = 3x - 1$.
L meets C at the points P and Q.
Find the coordinates of the midpoint of PQ.

Answer $(\ldots, \ldots)$

X7 The mass of rice in a sack is m kg.
$m = 6.4$, truncated to 1 decimal place.

(a) Write down the error interval for m. [2 marks]

Answer $\cdots \leq m < \ldots$

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(b) The rice is put into portions. Each portion has a mass of 0.15 kg, correct to 2 decimal places. [3 marks]
Work out the greatest number of portions that the sack can definitely fill.
You must show all your working.

Answer ... portions

Total for X7: 5 marks

X8 A box is a cuboid with a square base.
The base has sides of length x cm. The height of the box is $(x + 3)$ cm.
The volume of the box is $250\ \text{cm}^3$.

(a) Show that $x = \sqrt{\dfrac{250}{x+3}}$ [2 marks]

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(b) Use the iteration formula $x_{n+1} = \sqrt{\dfrac{250}{x_n + 3}}$ with $x_0 = 5$ to find the value of x_3

Give your answer correct to 2 decimal places.

[3 marks]

Answer $x_3 = \ldots$

Total for X8: 5 marks

X9 Kai says,

"For every positive integer n, the value of $2n^2 + 11$ is a prime number."

(a) Show that Kai is wrong.

[2 marks]

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(b) Prove that $2n^2 + 11$ is never a multiple of 3, for any integer n. [3 marks]

Total for X9: 5 marks

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X10 The diagram shows a square and a rectangle. [5 marks]

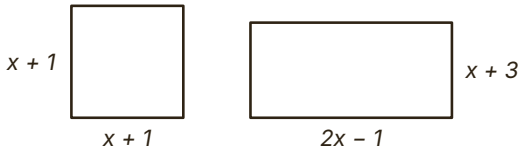
The square has sides of length $(x + 1)$ cm.

The rectangle has length $(2x - 1)$ cm and width $(x + 3)$ cm.

The area of the rectangle is greater than the area of the square.

Find the range of possible values of x.

You must show all your working.



Answer .....

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X11 The functions f and g are such that [5 marks]

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

Solve $gf(x) = fg(x)$.
Give your answers in the form $a \pm \sqrt{b}$, where a and b are integers.
You must show all your working.

Answer $x = \ldots$

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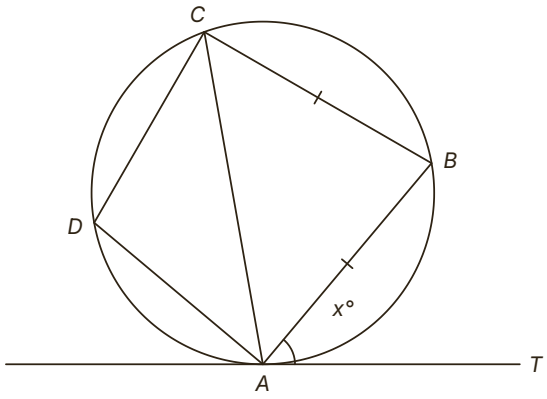
X12 A, B, C and D are points on a circle.
TA is the tangent to the circle at A.
$AB = BC$
Angle $TAB = x^\circ$
Diagram NOT accurately drawn



(a) Prove that angle $ADC = 2x^\circ$. [4 marks]
Give a reason for each stage of your working.

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(b) Angle $ADC = (3x - 33)^\circ$ [2 marks]

Work out the size of angle ABC.

Answer Angle $ABC = \ldots^\circ$

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**	Find $\overrightarrow{AB}$ by going $A \to O \to C \to B$.
	Hint 2	$\overrightarrow{MN} = \overrightarrow{MO} + \overrightarrow{OA} + \overrightarrow{AN}$, where $\overrightarrow{AN} = \frac{1}{2}\overrightarrow{AB}$.
	Hint 3	The $\mathbf{c}$ terms cancel and $\overrightarrow{MN}$ is a number times $\mathbf{a}$. Compare that number with the 6 in $\overrightarrow{OA} = 6\mathbf{a}$.
X2	**Hint 1**	Factorise $x^2 - x - 6$. One of its factors is $x + 2$.
	Hint 2	The common denominator is $(x-3)(x+2)$, so the numerator is $4(x-3) - (x-18)$.
	Hint 3	$-(x-18) = -x + 18$. The numerator is $3x + 6$; factorise it and cancel.
X3	**Hint 1**	Half of 8 is 4, so start with $(x+4)^2$.
	Hint 2	$(x+4)^2 = x^2 + 8x + 16$, so subtract 16 and add 19. The turning point of $y = f(x)$ is $(-4, 3)$.
	Hint 3	$-f(x)$ changes the sign of the y-coordinate. $f(-x)$ changes the sign of the x-coordinate. Use $(-4, 3)$ each time.
X4	**Hint 1**	Expand the two brackets on the top first and simplify.
	Hint 2	Then multiply the top and the bottom by $2 - \sqrt{5}$. Work out the denominator carefully: $4 - 5$ is negative.
	Hint 3	The top becomes $(2 - 5\sqrt{5})(2 - \sqrt{5}) = 29 - 12\sqrt{5}$ and the bottom is -1. Dividing by -1 changes both signs.
X5	**Hint 1**	Join O to P and O to T. The radius OP meets the tangent TP at a right angle.
	Hint 2	Find OT^2 from the coordinates of T. The radius squared is 17.
	Hint 3	OT is the hypotenuse of the right-angled triangle OPT, so $TP^2 = 125 - 17$. Simplify the surd.

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X6

Hint 1 Find P and Q first. Set $x^2 + x - 4$ equal to $3x - 1$.

Hint 2 Solve $x^2 - 2x - 3 = 0$ and use $y = 3x - 1$ to find the y-coordinates.

Hint 3 The points are $(3, 8)$ and $(-1, -4)$. The midpoint has coordinates (mean of the x-coordinates, mean of the y-coordinates).

X7

Hint 1 A truncated value is the number with the later digits cut off. It is not rounded.

Hint 2 For a number of portions that is certain, assume there is as little rice as possible and each portion is as heavy as possible.

Hint 3 The least mass is 6.4 kg and the greatest portion is 0.155 kg. Divide, then decide how many whole portions that gives.

X8

Hint 1 Volume of a cuboid = length $\times$ width $\times$ height. Here that is $x \times x \times (x + 3)$

Hint 2 Set $x^2(x + 3) = 250$, divide both sides by $x + 3$, then square root. For part (b), start with $x_1 = \sqrt{\dfrac{250}{5 + 3}}$.

Hint 3 $x_1 = \sqrt{31.25} = 5.590\ldots$ Use the full value of x_1 to find x_2, and the full value of x_2 to find x_3. Round only at the end.

X9

Hint 1 For part (a), try values of n. Think about a value that makes $2n^2$ and 11 share a factor.

Hint 2 For part (b), every integer is $3k$, $3k + 1$ or $3k + 2$. Substitute each one into $2n^2 + 11$.

Hint 3 Expand each case and write it as $3(\ldots) + 1$ or $3(\ldots) + 2$. For $n = 3k$ you get $18k^2 + 11 = 3(6k^2 + 3) + 2$.

X10

Hint 1 Write an expression for each area and expand the brackets.

Hint 2 Rectangle $2x^2 + 5x - 3$, square $x^2 + 2x + 1$. Form "rectangle $>$ square" and move everything to one side.

Hint 3 $x^2 + 3x - 4 > 0$ gives $x < -4$ or $x > 1$. Now use the fact that every side length must be positive.

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X11

Hint 1 Find $gf(x)$ and $fg(x)$ separately. The order matters: $gf(x)$ means do f first.

Hint 2 $gf(x) = (2x + 3)^2$ and $fg(x) = 2x^2 + 3$.

Hint 3 Set them equal and simplify to $x^2 + 6x + 3 = 0$. Complete the square: $(x + 3)^2 = 6$.

X12

Hint 1 The angle between the tangent TA and the chord AB is equal to the angle in the alternate segment. Which angle in triangle ABC is that?

Hint 2 Triangle ABC has $AB = BC$, so two of its angles are equal. Then find angle CAT in terms of x.

Hint 3 Use the alternate segment theorem again with the chord AC: angle CAT equals angle ADC. For part (b), set $2x = 3x - 33$, then use the cyclic quadrilateral $ABCD$.

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