Hints online, answers free with an account:
mathswariz.uk/worksheets/gcse-grade-8-9-mixed-revision-12/

Grade 8/9 mixed revision 12

48 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 The point $P(5, -8)$ lies on the circle with equation $x^2 + y^2 = 89$. [3 marks]
The tangent to the circle at P makes an acute angle θ with the x-axis.
Find the size of θ.
Give your answer correct to 1 decimal place.

Answer $\theta = \ldots^\circ$

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X2 Prove that, for any four consecutive integers, the product of the middle two integers is always 2 more than the product of the first and last integers. [3 marks]

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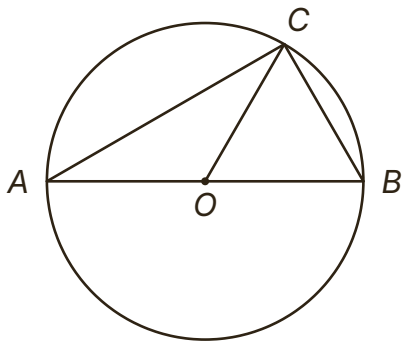
X3 A, B and C are points on a circle, centre O. [3 marks]

AB is a diameter of the circle.

Prove that angle $ACB = 90°$.

You must not use the circle theorem about the angle in a semicircle in your proof.

Diagram NOT accurately drawn



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X4 Simplify fully $\dfrac{x^3 - 9x}{2x^3 + 5x^2 - 3x}$ [3 marks]

Answer .....

X5 A block of cheese costs exactly £18. [3 marks]
The mass of the block is 2.5 kg, correct to 1 decimal place.
Work out the upper bound for the cost per kilogram of the cheese.
Give your answer correct to the nearest penny.

Answer £ ...

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X6 OAB is a triangle.

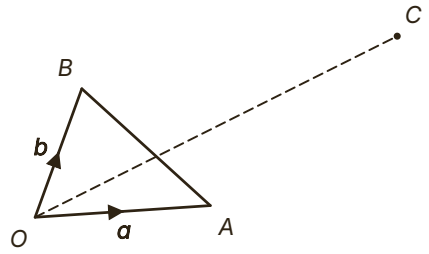
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

C is the point such that $\overrightarrow{OC} = 3\mathbf{a} + 2\mathbf{b}$.

D is the point such that $\overrightarrow{OD} = k\mathbf{a} + 6\mathbf{b}$, where k is a constant.

CD is parallel to AB.

Diagram NOT accurately drawn



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

Answer $k = \ldots$

(b) Find the ratio $CD : AB$. [1 mark]

Answer $\cdots : \ldots$

Total for X6: 4 marks

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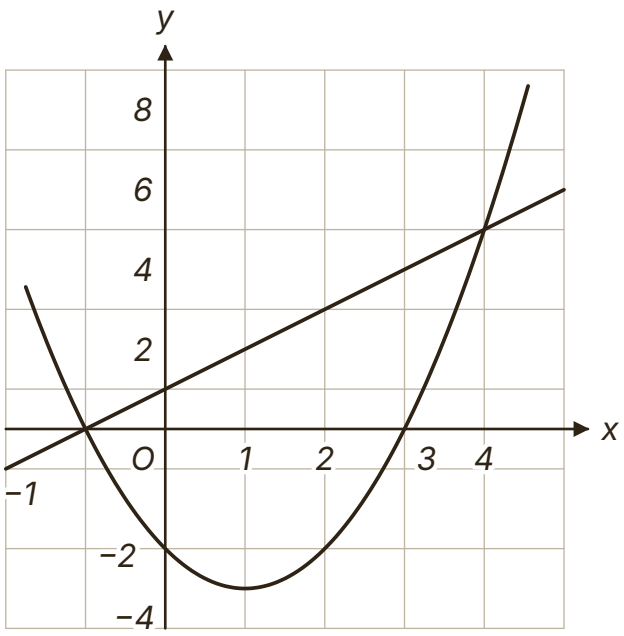
X7 The graph of $y = x^2 - 2x - 3$ and the line $y = x + 1$ are drawn on the grid.



(a) Use the graph to write down the solution of $x^2 - 2x - 3 \leqslant 0$ [2 marks]

Answer .....

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(b) Use the graph to find the set of values of x for which $x^2 - 2x - 3 > x + 1$ [2 marks]

Answer .....

Total for X7: 4 marks

X8 The functions f and g are such that [4 marks]

$$f(x) = x^2 + 1 \qquad g(x) = 2x - 3$$

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

Answer $x = \ldots$

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X9 The equation $x^3 + 2x^2 = 20$ has one positive solution. [4 marks]

By considering a change of sign, find this solution correct to 1 decimal place.

You must show all your working.

Answer $x = \ldots$

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X10 Solve the simultaneous equations [5 marks]

$$x^2 + y^2 = 27$$

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

Give your answers in surd form where necessary.
You must show all your working.

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

X11 The graph of $y = 2^x$ is translated by the vector $\begin{pmatrix} 3 \\ -8 \end{pmatrix}$.

The new graph has equation $y = g(x)$.

(a) Write down an expression for $g(x)$. [1 mark]

Answer $g(x) = \ldots$

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(b) Find the coordinates of the point where the graph of $y = g(x)$ crosses the x-axis. [2 marks]

Answer $(\ldots, \ldots)$

(c) Find the coordinates of the point where the graph of $y = g(x)$ crosses the y-axis. [2 marks]

Answer $(\ldots, \ldots)$

(d) As x decreases, the graph of $y = g(x)$ gets closer and closer to a horizontal line without meeting it.
Write down the equation of this line. [1 mark]

Answer ...

Total for X11: 6 marks

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X12 The line L passes through the points $P(1, 2)$ and $Q(\sqrt{3}, 4)$.

(a) Show that the gradient of L is $1 + \sqrt{3}$. [3 marks]

(b) L crosses the x-axis at the point R. [3 marks]

Find the x-coordinate of R. Give your answer in the form $a + b\sqrt{3}$, where a and b are integers.

You must show all your working.

Answer $x = \ldots$

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 The angle a line makes with the x-axis comes from its gradient: gradient $= \tan\theta$.

Hint 2 You need the gradient of the tangent, not of the radius. The tangent is perpendicular to OP.

Hint 3 The gradient of OP is $-\frac{8}{5}$, so the tangent has gradient $\frac{5}{8}$. Use $\tan^{-1}$.

X2

Hint 1 Write the four integers as n, $n+1$, $n+2$, $n+3$.

Hint 2 Multiply the middle two, then multiply the first and the last.

Hint 3 Expand both and subtract. The n^2 and $3n$ terms cancel.

X3

Hint 1 OA, OB and OC are all radii. Look at triangles OAC and OBC.

Hint 2 Let angle $OAC = a$ and angle $OBC = b$. Which other angles are equal to these?

Hint 3 Angle $ACB = a + b$. Add up the angles in triangle ABC to get an equation in $a + b$.

X4

Hint 1 Both the numerator and the denominator have a common factor of x. Take it out first.

Hint 2 $x^2 - 9$ is a difference of two squares. $2x^2 + 5x - 3$ factorises into two brackets.

Hint 3 $2x^2 + 5x - 3 = (2x - 1)(x + 3)$. Cancel x and $(x + 3)$.

X5

Hint 1 The price is exact, so it has no bounds. Write down the bounds of the mass.

Hint 2 Cost per kilogram is cost divided by mass. Dividing by a smaller number gives a larger answer.

Hint 3 Work out $18 \div 2.45$ and round to the nearest penny.

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X6

Hint 1 Write $\overrightarrow{CD} = \overrightarrow{OD} - \overrightarrow{OC}$ in terms of k, and write $\overrightarrow{AB}$.

Hint 2 Parallel vectors are multiples of each other. The $\mathbf{b}$ terms of $\overrightarrow{CD}$ and $\overrightarrow{AB}$ tell you which multiple.

Hint 3 $\overrightarrow{CD}$ has $4\mathbf{b}$ and $\overrightarrow{AB}$ has $1\mathbf{b}$, so $\overrightarrow{CD} = 4\,\overrightarrow{AB}$. Make the $\mathbf{a}$ terms agree: $k - 3$ must be 4 times the coefficient of $\mathbf{a}$ in $\overrightarrow{AB}$. Watch the sign.

X7

Hint 1 The solutions of $x^2 - 2x - 3 = 0$ are where the curve crosses the x-axis.

Hint 2 For part (b), find the x values where the curve and the line cross.

Hint 3 They cross at $x = -1$ and $x = 4$. The curve is above the line to the left of -1 and to the right of 4.

X8

Hint 1 Find $g^{-1}(x)$ first.

Hint 2 $g^{-1}(x) = \dfrac{x+3}{2}$. Set $x^2 + 1 = \dfrac{x+3}{2}$.

Hint 3 Multiply both sides by 2 and collect the terms to get $2x^2 - x - 1 = 0$, then factorise.

X9

Hint 1 Rearrange to $x^3 + 2x^2 - 20 = 0$ and try whole numbers, then values to 1 decimal place.

Hint 2 The sign changes between $x = 2.1$ and $x = 2.2$. That alone does not tell you which of the two the solution rounds to.

Hint 3 Substitute the halfway value 2.15. Its sign tells you which half of the interval the solution is in.

X10

Hint 1 The second equation gives y^2 directly. Put it in place of y^2 in the first equation.

Hint 2 $x^2 + 5x - 24 = 0$ has two solutions. For each one, work out y^2 from $y^2 = 5x + 3$.

Hint 3 One value of x gives a negative value of y^2, so it is not possible. The other gives $y^2 = 18$, which has two square roots.

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X11

Hint 1 A translation by $\begin{pmatrix} 3 \\ -8 \end{pmatrix}$ moves the graph 3 right and 8 down: replace x by $x - 3$ and subtract 8.

Hint 2 On the x-axis $y = 0$, so solve $2^{x-3} = 8$ by writing 8 as a power of 2. On the y-axis $x = 0$.

Hint 3 $2^{-3} = \dfrac{1}{8}$. The graph of $y = 2^x$ gets closer to the line $y = 0$ as x decreases; move that line down 8.

X12

Hint 1 Gradient $= \dfrac{\text{change in } y}{\text{change in } x}$. The change in x is $\sqrt{3} - 1$.

Hint 2 Rationalise $\dfrac{2}{\sqrt{3} - 1}$. For (b), write the equation of L using P and the gradient, then put $y = 0$.

Hint 3 You get $x - 1 = \dfrac{-2}{1 + \sqrt{3}}$. Multiply the top and the bottom by $\sqrt{3} - 1$; the bottom is 2.

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