

GETTING AHEAD



HAVANT

Start to develop skills that are relevant to your course before you join HSDC this September!

A Level Mathematics Number 2

This is the second set of tasks we have prepared for you to help you get ready to start studying A Level Mathematics. The first set of tasks involved solving some of the more challenging GCSE Mathematics questions, just on the topics that come up again in the A Level Course, so if you haven't done this yet, please do so.

Activities

Please complete all these tasks. You can write your answers on separate paper; you don't have to print it out, although we have provided some graph templates if you did print them out (Or you can also simply draw your own set of axes on paper).

Task 1 – Quadratic Functions

Use each of these Quadratics for the whole of this task:

- a) $x^2 - 2x - 8 = 0$
- b) $4x^2 - 4x + 1 = 0$
- c) $x^2 + 2x - 5 = 0$
- d) $2x^2 + 8x + 3 = 0$
- e) $x^2 - 4x + 5 = 0$
- f) $3x^2 - 6x + 4 = 0$

Now do the following **for each** of the above quadratics:

- i) Factorise them (this is only possible for 2 of these quadratics)
- ii) Solve them using the quadratic formula

(this is only possible for 4 of these quadratics)

iii) Make a table of values for the given x values, and find the y coordinate for each of these

a)

x	-3	-2	-1	0	1	2	3	4	5
y									

b)

x	-2	-1	0	1	2	3
y						

c)

x	-4	-3	-2	-1	0	1	2
y							

d)

x	-5	-4	-3	-2	-1	0	1
y							

e)

x	-1	0	1	2	3	4	5
y							

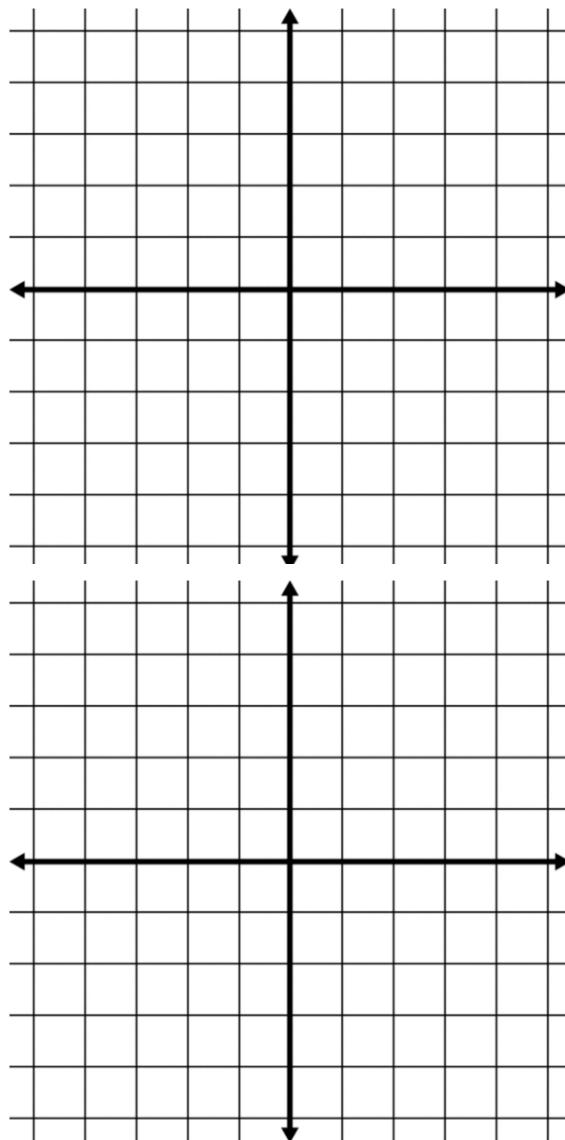
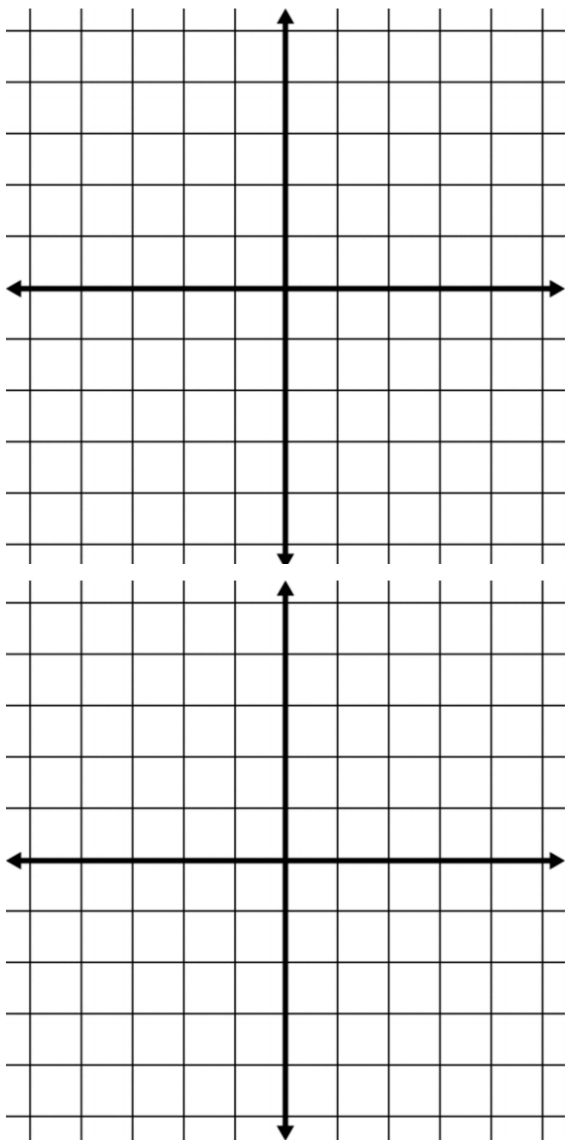
f)

x	-1	0	1	2	3
y					

iv) Plot the graph of each of these using the coordinates from (iv). You can use the templates below or you can draw your own set of axes. **You must choose the scale on the y -axis yourself to make it fit, it's not the same.**

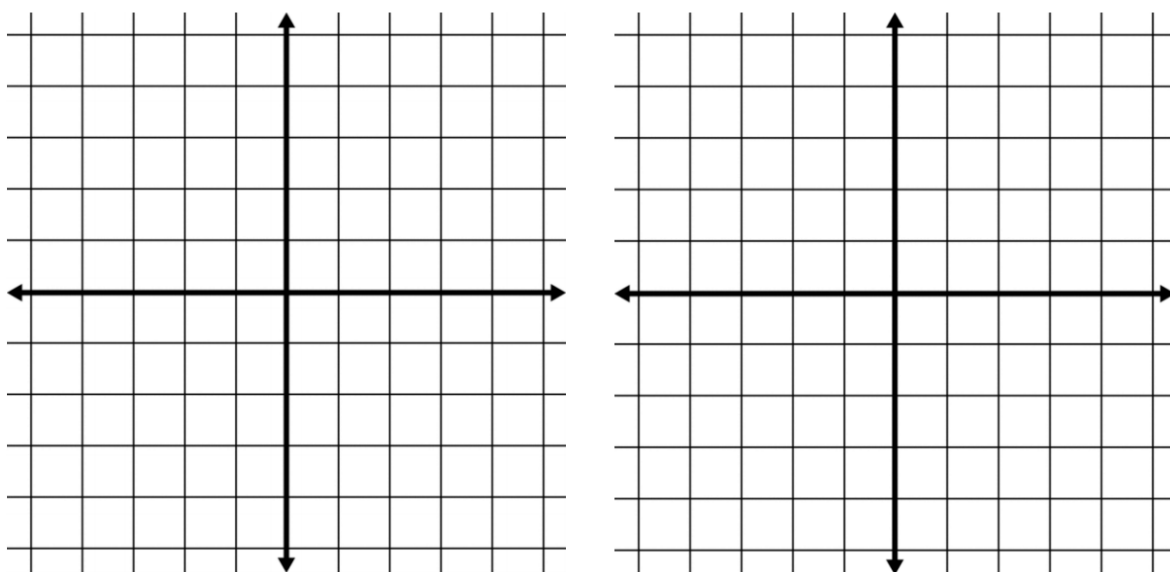
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v) Write each of them in the form $a(x + b)^2 + c$ (otherwise known as *completing the square*). This can be done for all 6.

Watch these videos to see how to do this if you don't know:

<https://www.youtube.com/watch?v=0V7C-7NgCmc> and

<https://www.youtube.com/watch?v=CXEaqByN2u4>

Task 2 – Quadratic Properties

For each of the quadratics (a) – (f) in Task 1, by looking at their graphs, think about:

- **Why** is it that only two could be factorised?
- **Why** could only four be solved with the formula?
- **How** does the completed square form match up with the minimum point?
- **Is** there a quicker way that we can use the quadratic formula to work out whether the minimum point would be above or below the axes?

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Task 3

Please follow each of these links and complete the activities based on the content you need to know for some of the first A Level Mathematics topics we look at in the first few weeks on Surds, Indices and Rearranging:

Surds - https://amsp.org.uk/uploads/files/Simplifying-Surdsv1_6.pdf

Indices - <https://amsp.org.uk/uploads/files/indices-presentation.pdf>

Rearranging - https://amsp.org.uk/uploads/files/Rearranging1v1_1.pdf

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Solutions

Please check all your answers with those given below.

Task 1

a) $x^2 - 2x - 8 = 0$

i) $(x - 4)(x + 2)$

ii) $x = 4$ or -2

iii) $(x - 1)^2 - 9$

b) $4x^2 - 4x + 1 = 0$

i) $(2x - 1)(2x - 1)$

ii) $x = 1/2$

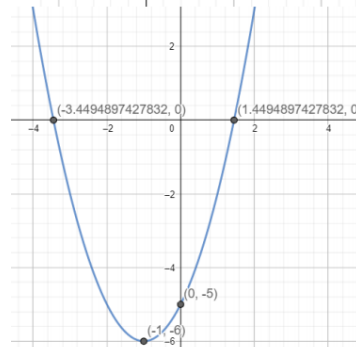
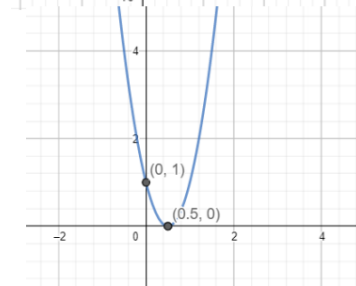
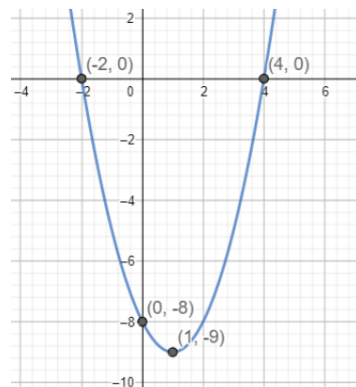
iii) $4(x - 1/2)^2$

c) $x^2 + 2x - 5 = 0$

i) Cannot factorise

ii) $x = -1 \pm \sqrt{6}$ (or 1.45 and -3.45)

iii) $(x + 1)^2 - 6$



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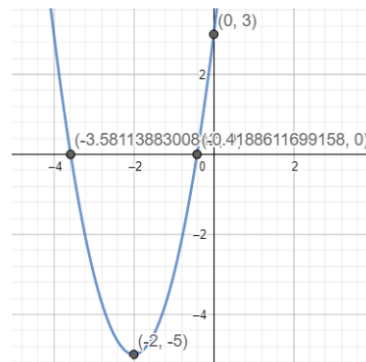
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d) $2x^2 + 8x + 3 = 0$

i) Cannot factorise

ii) $x = \frac{-4 \pm \sqrt{10}}{2}$

iii) $2(x + 2)^2 - 5$

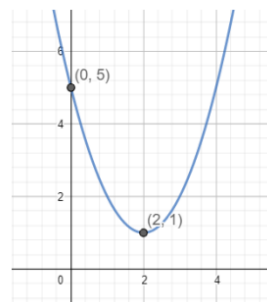


e) $x^2 - 4x + 5 = 0$

i) Cannot factorise

ii) Cannot Solve with formula (as negative square root)

iii) $(x - 2)^2 + 1$

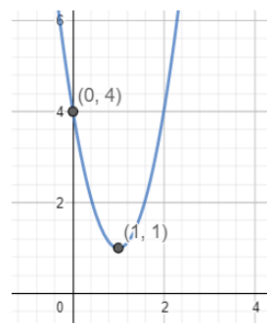


f) $3x^2 - 6x + 4 = 0$

i) Cannot factorise

ii) Cannot Solve with formula (as negative square root)

iii) $3(x - 1)^2 + 1$




Task 2

- The Quadratics could only be factorised if the graphs cross the x -axis at rational solutions (e.g. whole numbers or fractions)
- You can only use the quadratic formula if the graph crosses the x -axis anywhere. Otherwise there is a negative inside the square root so it fails
- Once in the form $a(x + b)^2 + c$, the min point is always $(-b, c)$. Also, once in completed square form, if the "c" is positive it will be above the x -axis and that means the formula would have no real solutions
- The key part of the quadratic formula is the part inside the square root, called the **discriminant** or $b^2 - 4ac$. IF this is bigger than zero, the graph crosses the x -axis twice. If it equals 0 (as in (b)) the graph sits on the axis or has one repeated root. If $b^2 - 4ac < 0$ then the minimum point is above the x -axis

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Additional Reading If you wish to get more Mathematics practice in before you start A Level, or if you want to look ahead at what types of things we will be studying in the first year, check out these links as an optional extra.

<https://www.mathsgenie.co.uk/homeschool.html> - you should do Stream C if you wish.

<https://ocr.org.uk/qualifications/as-and-a-level/mathematics-a-h230-h240-from-2017/specification-at-a-glance/#as-level> – this is a link to our exam board OCR and the first- year specification

<https://www.edx.org/course/a-level-mathematics-for-year-12-course-1-algebraic> - this is a free course from Imperial College London looking at the first few pure topics on A Level Mathematics, which would give you a great head start if you want.

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