"Full Coverage": Completing the Square

This worksheet is designed to cover one question of each type seen in past papers, for each GCSE Higher Tier topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Complete the square when the coefficient of x^2 is 1.

[Edexcel GCSE Nov2006-5H Q20b Edited]
Given that $x^2 + 6x - 5 = (x + p)^2 + q$ for all values of x, find the values of p and q .

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Question 2

Categorisation: Complete the square when the coefficient of x is negative.

[Edexcel GCSE Nov2005-5H Q21b]
Show that $x^2 - 4x + 15$ can be written as $(x + p)^2 + q$ for all values of x .
State the values of p and q.

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Question 3

Categorisation: Be careful when the desired form is written as $(x - p)^2 + q$ rather than $(x + p)^2 + q$.

[Edexcel GCSE June2007-5H Q26a]
For all values of x,

$$x^2 - 6x + 15 = (x - p)^2 + q$$

Find the value of p and the value of q.

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Question 4

Categorisation: Deal with algebraic coefficients.

[Edexcel GCSE June2003-6H Q18a]

For all values of x and m, $x^2 - 2mx = (x - m)^2 - k$

Express k in terms of m.

$$k = \text{...........................}$$

Question 5

Categorisation: Understand that the 'minimum value of an expression' is the minimum output, e.g. the minimum value of $x^2 + 4x + 10 = (x + 2)^2 + 6$ is 6.

[Edexcel GCSE June2003-6H Q18bi]

The expression $x^2 - 2mx$ has a minimum value as x varies.

Find the minimum value of $x^2 - 2mx$.

Give your answer in terms of m.

$$\text{...........................}$$

Question 6

Categorisation: Determine the value of x for which a minimum/maximum occurs.

[Edexcel GCSE June2003-6H Q18bii]

The expression $x^2 - 2mx$ has a minimum value as x varies.

State the value of x for which this minimum value occurs.

Give your answer in terms of m.

$$x = \text{...........................}$$

Question 7

Categorisation: Complete the square when the coefficient of x^2 is not 1 (and positive).

[Edexcel Specimen Papers Set 2, Paper 3H Q23a]
Write $2x^2 + 16x + 35$ in the form $(x + b)^2 + c$, where a, b and c are integers.

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Question 8

Categorisation: Understand the term 'turning point' and determine it for a quadratic where the coefficient of x^2 is not 1.

[Edexcel Specimen Papers Set 2, Paper 3H Q23b]
Determine the coordinates of the turning point of the graph of $y = 2x^2 + 16x + 35$
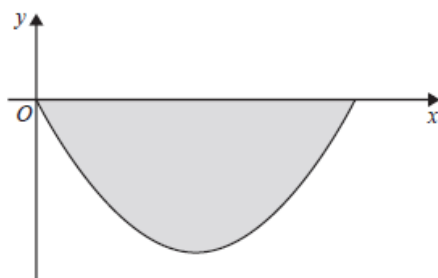
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Question 9

Categorisation: Deal with fractional coefficients of x^2 and understand minimum/maximum value in context, e.g. depth of a bowl.

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 1H Q15]
Here is a sketch of a vertical cross section through the centre of a bowl.

The cross section is the shaded region between the curve and the x-axis.

The curve has equation $y = \frac{x^2}{10} - 3x$ where x and y are both measured in centimetres.

Find the depth of the bowl.

.... cm

Question 10

Categorisation: Determine the turning point when the coefficient of x^2 is 1.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 2H Q19]

By completing the square, find the coordinates of the turning point of the curve with equation $y = x^2 + 10x + 18$ You must show all your working.
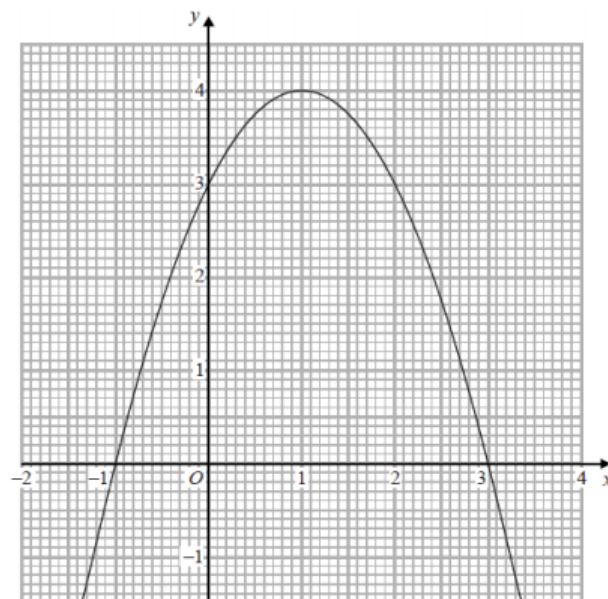
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Question 11

Categorisation: Identify a turning point from a graph.

[Edexcel New SAMS Paper 2H Q7a]

The graph of $y = f(x)$ is drawn on the grid.

Write down the coordinates of the turning point of the graph.

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Question 12

Categorisation: Complete the square for negative coefficients of x^2.

Put $-x^2 + 8x - 5$ in the form $(x + b)^2 + c$, where a, b, c are constants.

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Question 13

Categorisation: Complete the square when the coefficient of x is odd.

Write $x^2 + 5x + 9$ in the form $(x + a)^2 + b$, where a, b are constants.

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Answers

Question 1
$p = 3$, $q = -14$

Question 2
$p = -2$, $q = 11$

Question 3
$p = 3$, $q = 6$

Question 4
$k = m^2$

Question 5
$-m^2$

Question 6
$x = m$

Question 7
$2(x + 4)^2 + 3$

Question 8
$(-4, 3)$

Question 9
22.5 cm

Question 10
$(-5, -7)$

Question 11
$(1, 4)$

Question 12
$-(x - 4)^2 + 11$

Question 13
$\left(x + \frac{5}{2}\right)^2 + \frac{9}{4}$