Essential GCSE Maths 29.1

GCSE P P P A Level P P P

Express the following in completed square form.

Part A $x^2 - 2x - 8$

$x^2 - 2x - 8$

- $(x-2)^2 - 12$
- $(x-1)^2 - 6$
- $(x+1)^2 - 8$
- $(x-1)^2 - 9$

Part B $x^2 + 6x - 5$

$x^2 + 6x - 5$

- $(x+6)^2 - 5$
- $(x+6)^2 - 41$
- $(x+3)^2 - 14$
- $(x-3)^2 - 14$

Essential GCSE Maths 29.3

GCSE A Level

Express the following in completed square form.

Give your answers in the form $b(x+a)^2+c$, use improper (top heavy) fractions rather than mixed fractions in your answers.

Part A $2x^2-8x+2$

$$2x^2-8x+2$$

The following symbols may be useful: x

Part B $3x^2-18x-7$

$$3x^2-18x-7$$

The following symbols may be useful: x

Gameboard:

STEM SMART Single Maths 2 - Quadratic Equations

Factorise 1

GCSE P P P A Level P P P

Consider the equation $3b^2 - 2b - 1 = 0$.

Part A Factorise the left hand side

Give the factorised form of the expression on the left hand side of the equation.

The following symbols may be useful: b

Part B Find the root closest to zero

Give the exact value of the root closest to zero.

The following symbols may be useful: b

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Quadratic Equations 4

GCSE C C C A Level P P P

Find the value of v closest to zero if

$$\frac{3-v}{1-3v} = \frac{2+v}{1+2v}.$$

Please answer to 3 s.f.

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Essential GCSE Maths 27.4

GCSE P P P A Level P P P

Without drawing graphs, find for each function:

(i) the y-intercept (ii) where the graph crosses the x-axis.

Part A $y = x^2 + x - 2$

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

(i) Find the y-intercept

(ii) Where does the graph cross the x-axis?

Enter the lower value.

Enter the higher value.

Part B $y = x^2 + 6x + 5$

$$y = x^2 + 6x + 5$$

(i) Find the y-intercept

(ii) Where does the graph cross the x-axis?

Enter the lower value.

Enter the higher value.

Part C $y = x^2 - 8x + 15$

$$y = x^2 - 8x + 15$$

(i) Find the y-intercept

(ii) Where does the graph cross the x-axis?

Enter the lower value.

Enter the higher value.

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STEM SMART Single Maths 2 - Quadratic Equations

Essential GCSE Maths 27.11

GCSE C C C A Level C C C

The formula $s = ut + \frac{1}{2}at^2$ is used to calculate the height s of projectiles (such as balls) as a function of time.

Plot a graph of s against t for $0 \leqslant t \leqslant 7$, given that $u = 29.43\,\mathrm{m/s}$ and $a = -9.81\,\mathrm{m/s^2}$.

Part A What is the maximum height?

What is the maximum height reached? Give your answer to 3 s.f..

Part B How long to return to its starting height?

How long does a projectile modelled by this graph take to return to its starting height? You may assume the projectile was launched at $t = 0$. Give your answer to 3 s.f..

Part C What is the relative position of the projectile?

At $t = 7\,\mathrm{s}$, what is the height of the projectile relative to its starting position? Give your answer to 3 s.f..

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STEM SMART Single Maths 2 - Quadratic Equations

Quadratics: Graphs and Discriminants 1ii

A Level

Part A Find discriminant

Calculate the discriminant of $-2x^2 + 7x + 3$.

Hence choose the correct option that gives the number of *distinct* real roots to the equation $-2x^2 + 7x + 3 = 0$

- Zero
- Two
- One

Part B Possible values of p

The quadratic equation $2x^2 + (p + 1)x + 8 = 0$ has equal roots. Find the possible values of p and enter the greatest possible value of p.

The following symbols may be useful: p

Gameboard:
STEM SMART Single Maths 2 - Quadratic Equations

Quadratics: Graphs and Discriminants 3ii

A Level

Part A Roots of equation

Find the roots of the equation $x^2 + 8x + 10 = 0$. Give your answer in the form $a \pm b$, where a and b are in simplified surd form.

The following symbols may be useful: ±

Part B Sketch the curve

Sketch the curve $y = x^2 + 8x + 10$, giving the coordinates of the points where the curve crosses the axes.

Give the y coordinate of the point at which the curve crosses the y-axis.

The following symbols may be useful: y

Part C Solve inequality

Solve the inequality $x^2 + 8x + 10 \leq 0$.

What form does your answer take? Choose from the list below, where a and b are constants and $a < b$, and then find a and/or b.

- $x < a$
- $x \leq a$
- $x > a$
- $x \geq a$
- $a < x < b$
- $a \leq x \leq b$
- $x < a$ or $x > b$
- $x \leq a$ or $x \geq b$

Write down the value of a.

Write down the value of b (or if your chosen form has no b, write "n").

The following symbols may be useful: n

Gameboard:

STEM SMART Single Maths 2 - Quadratic Equations

Quadratic Inequalities

GCSE C C C A Level P P P

Solve the following quadratic inequalities.

Part A $3x^2 - 2x - 8 \leq 0$

Solve the inequality $3x^2 - 2x - 8 \leq 0$. Firstly select the form of your answer from the choices given below, where a and b are constants and $a < b$, and then find a and/or b.

Select the form of your answer from the choices given below.

- $x > b$ only
- $x \leq a$ or $x \geq b$
- $x < a$ or $x > b$
- $a < x < b$
- $x \geq b$ only
- $x \leq a$ only
- $x < a$ only
- $a \leq x \leq b$

Given your deduction above, find a.

Given your deduction above, find b.

Part B $-2x^2 + 5 < 7x + 11$

Solve the inequality $-2x^2 + 5 < 7x + 11$. Firstly select the form of your answer from the choices given below, where c and d are constants, and then find c and/or d.

Select the form of your answer from the choices given below.

- $x < c$ only
- $c \leq x \leq d$
- $x > d$ only
- $c < x < d$
- $x < c$ or $x > d$
- $x \leq c$ or $x \geq d$
- $x \leq c$ only
- $x \geq d$ only

Given your deduction above, find c.

Given your deduction above, find d.

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Physics. You work it out.

Quadratic Equations 5

GCSE C C C A Level P P P

Show that the solution to the equation $mp^2 + bp + k = 0$ can be written as $p = -\gamma \pm \sqrt{\gamma^2 - \omega^2}$.

Part A Find an expression for γ

Hence find an expression for γ in terms of one or more of the constants m, b and k in the original equation.

The following symbols may be useful: `b, gamma, k, m, omega`

Part B Find an expression for ω

Also give an expression for ω in terms of one or more of the constants m, b and k.

The following symbols may be useful: `b, gamma, k, m, omega`

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