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# Essential GCSE Maths 29.1



Express the following in completed square form.

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

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

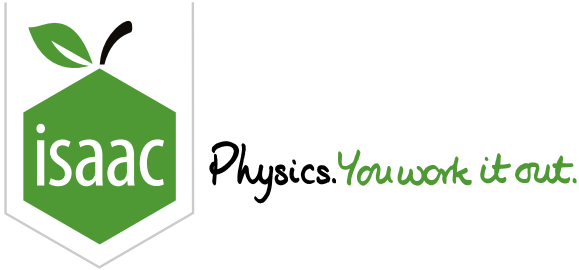
- ☐  $(x - 2)^2 - 12$
- ☐  $(x - 1)^2 - 6$
- ☐  $(x + 1)^2 - 8$
- ☐  $(x - 1)^2 - 9$

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

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

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

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# 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:  $x$

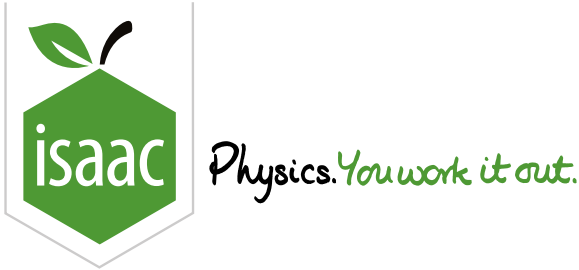
Part B    $3x^2 - 18x - 7$

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

The following symbols may be useful:  $x$

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Factorise 1

GCSE

A Level



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.

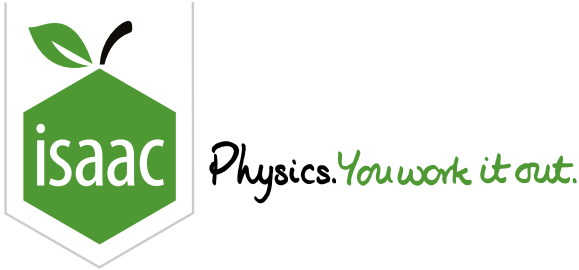
The following symbols may be useful: b

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# Quadratic Equations 4

GCSE

A Level

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



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.

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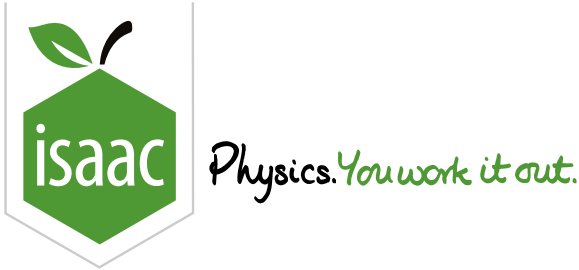
Enter the higher value.

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# Essential GCSE Maths 27.11

GCSE

A Level

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  $0 \leq t \leq 7$ , given that  $u = 29.43 \text{ m/s}$  and  $a = -9.81 \text{ m/s}^2$ .

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

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# 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:  $p$

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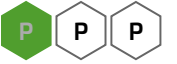


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# Quadratics: Graphs and Discriminants 3ii

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:  $\pm$

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## 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:  $y$

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**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  $a$ .

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

The following symbols may be useful: n

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# Quadratic Inequalities

GCSE

A Level



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

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Given your deduction above, find  $c$ .

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Given your deduction above, find  $d$ .

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# Quadratic Equations 5

GCSE

A Level



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 $\gamma$

Hence find an expression for  $\gamma$  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 $\omega$

Also give an expression for  $\omega$  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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