



Physics. *You work it out.*

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Essential GCSE Maths 12.14



A postman delivers mail to four houses. House 1 receives $3s$ letters and t parcels. House 2 receives $7s$ letters. House 3 receives $5s$ letters and $2t$ parcels. House 4 receives t parcels.

Part A Write the information as an equation

Write an equation for the total number of items the four houses receive, N . Simplify your answer as far as possible.

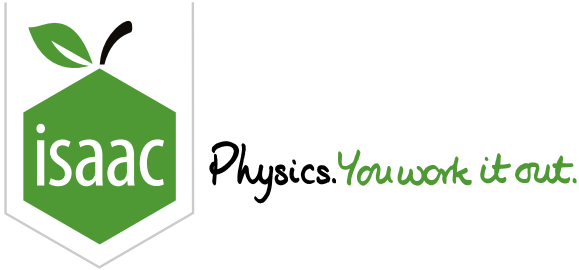
The following symbols may be useful: N , s , t

Part B Write an equation for C

Assuming that the cost to send a letter is 80 pence and the cost to send a parcel is £5.50, write an equation for C , the total cost in pounds to send all the items that were delivered.

The following symbols may be useful: C , s , t

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Essential GCSE Maths 12.16

GCSE

A Level

Write the following statements in algebra.

Part A α is twice β

α is twice β .

The following symbols may be useful: alpha, beta

Part B α cubed is the same as γ squared

α cubed is the same as γ squared.

The following symbols may be useful: alpha, gamma

Part C Using your equations

$\beta = 2$ and γ is a positive integer.

Find the value of γ .

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Essential GCSE Maths 14.12



This question makes use of the Isaac equation editor, you can find instruction on [how to use the equation editor here](#).

Expand and simplify the following.

Part A $(x + 1)(x + 2)(x + 3)$

$$(x + 1)(x + 2)(x + 3)$$

The following symbols may be useful: x

Part B $(x - 5)(2x - a + 4)$

$$(x - 5)(2x - a + 4)$$

The following symbols may be useful: a , x

Part C $(x - 3)(x - 7)^2$

$$(x - 3)(x - 7)^2$$

The following symbols may be useful: x

Part D $\left(\frac{1}{x} + 5\right)(3x^2 - 9)$

$$\left(\frac{1}{x} + 5\right)(3x^2 - 9)$$

The following symbols may be useful: x

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Essential GCSE Maths 15.8



Simplify the following, factorising if possible.

Part A $3x^2 \times 2a \times ax^3$

$$3x^2 \times 2a \times ax^3$$

The following symbols may be useful: a , x

Part B $7p \times \frac{1}{2}x^2 \div \frac{p}{4} - 7x$

$$7p \times \frac{1}{2}x^2 \div \frac{p}{4} - 7x$$

The following symbols may be useful: p , x

Part C $3c \times \left(\frac{1}{2}x\right)^2 \times 8c^2x + 4c^3$

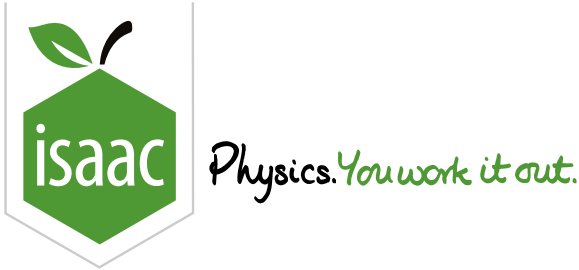
$$3c \times \left(\frac{1}{2}x\right)^2 \times 8c^2x + 4c^3$$

The following symbols may be useful: c , x

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Simplifying Indices

GCSE

A Level

Part A Simplify $(4a^2b^3)^{\frac{1}{2}} \times (9ab^2)^{-\frac{3}{2}}$

Simplify $(4a^2b^3)^{\frac{1}{2}} \times (9ab^2)^{-\frac{3}{2}}$

The following symbols may be useful: a, b, p, q

Part B Simplify $(8p^3q^2)^{\frac{2}{3}} \div \left(\frac{2p}{q^{\frac{1}{3}}}\right)^5$

Simplify $(8p^3q^2)^{\frac{2}{3}} \div \left(\frac{2p}{q^{\frac{1}{3}}}\right)^5$

The following symbols may be useful: a, b, p, q

Part C Simplify $(10^{-34})^{\frac{1}{2}}(10^{-10})^{\frac{1}{2}}(10^8)^{-\frac{5}{2}}$

Simplify $(10^{-34})^{\frac{1}{2}}(10^{-10})^{\frac{1}{2}}(10^8)^{-\frac{5}{2}}$

The following symbols may be useful: a, b, p, q

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Simplifying Surds

GCSE

A Level

Simplify the following expressions.

Part A $2\sqrt{20} + \sqrt{45} - 5\sqrt{5}$

Simplify $2\sqrt{20} + \sqrt{45} - 5\sqrt{5}$

Part B $4(\sqrt{3} + 1)(\sqrt{3} - 1) - 2(2 + \sqrt{2})(1 + \sqrt{2})$

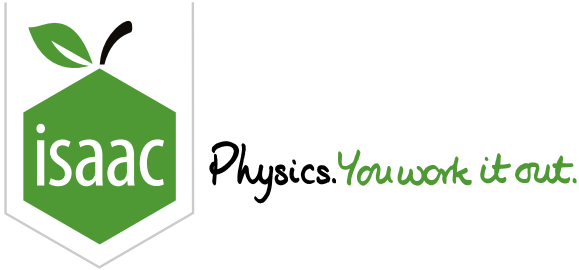
Simplify $4(\sqrt{3} + 1)(\sqrt{3} - 1) - 2(2 + \sqrt{2})(1 + \sqrt{2})$

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Rationalisation

GCSE

A Level

Rationalise the denominators of the following expressions.

Part A

$\frac{3\sqrt{6}}{2\sqrt{18}}$

Rationalise the denominator of $\frac{3\sqrt{6}}{2\sqrt{18}}$.

Part B

$\frac{4-\sqrt{3}}{4+2\sqrt{3}}$

Rationalise the denominator of $\frac{4-\sqrt{3}}{4+2\sqrt{3}}$.

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Algebraic Manipulation 4.1



Rearrange each of the following equations to make the indicated symbol the subject.

Part A Find b if $\frac{1}{4a} - \frac{c}{3b} = 1$

Make b the subject of the equation $\frac{1}{4a} - \frac{c}{3b} = 1$.

The following symbols may be useful: a , b , c

Part B Find q if $p = \frac{2}{q^2} + \frac{3}{r}$

Consider the equation $p = \frac{2}{q^2} + \frac{3}{r}$. Show that if you make q the subject of this equation it can be written in the form $q = \pm S$ and find an expression for S .

The following symbols may be useful: S , p , r

Part C Find x if $\frac{1}{x^2} - \frac{a}{z^2} = b$

Consider the equation $\frac{1}{x^2} - \frac{a}{z^2} = b$. Show that if you make x the subject of this equation it can be written in the form $x = \pm Y$ and find an expression for Y .

The following symbols may be useful: Y , a , b , z

Part D Find m if $\frac{m}{a} + \frac{n}{b} = c$

Make m the subject of the equation $\frac{m}{a} + \frac{n}{b} = c$.

The following symbols may be useful: a , b , c , m , n

Part E Find s if $\frac{2}{r} - \frac{5}{s} = 6$

Make s the subject of the equation $\frac{2}{r} - \frac{5}{s} = 6$.

The following symbols may be useful: r , s

Part F Find r if $\frac{1}{p} = \frac{1}{q} + \frac{1}{r}$

Make r the subject of $\frac{1}{p} = \frac{1}{q} + \frac{1}{r}$.

The following symbols may be useful: p , q , r

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Algebraic Manipulation 4.2

GCSE

A Level



Write each of the following as a single fraction in its simplest form.

Part A $\frac{2}{a} - \frac{3}{a+1}$

Write $\frac{2}{a} - \frac{3}{a+1}$ as a single fraction in its simplest form.

The following symbols may be useful: a

Part B $\frac{3}{2r} - \frac{4}{3r-1}$

Write $\frac{3}{2r} - \frac{4}{3r-1}$ as a single fraction in its simplest form.

The following symbols may be useful: r

Part C $\frac{1}{b+4} + \frac{2}{2b+3}$

Write $\frac{1}{b+4} + \frac{2}{2b+3}$ as a single fraction in its simplest form.

The following symbols may be useful: b

Part D $-\frac{2}{s-2} + \frac{5}{s+3}$

Write $-\frac{2}{s-2} + \frac{5}{s+3}$ as a single fraction in its simplest form.

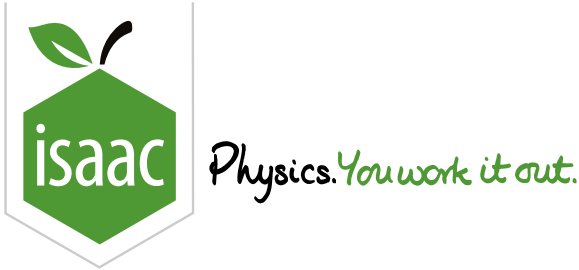
The following symbols may be useful: s

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Algebraic Manipulation 5.4

GCSE A Level

c

c

c

c

c

c

Consider the following equations

$$w_x = \frac{c \cos \theta - v}{1 - \frac{v \cos \theta}{c}}$$

$$w_y = \frac{c \sin \theta}{\gamma \left(1 - \frac{v \cos \theta}{c}\right)}$$

where $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$.

Find an expression for $w = \sqrt{w_x^2 + w_y^2}$ in terms of one of either v , c or θ .

The following symbols may be useful: c , $\cos()$, $\sin()$, $\tan()$, θ , v , w

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