



Physics. *You work it out.*

[Home](#)   [Maths](#)   [Algebra](#)   [Series](#)   [Expand and simplify binomials](#)

# Expand and simplify binomials

**A Level**   **Further A**

## Part A   $(x + 1)^4$

Expand and simplify  $(x + 1)^4$ . (Give your answer in descending powers of  $x$ .)

The following symbols may be useful:  $x$

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## Part B   $(z + 2a)^3$

Expand and simplify  $(z + 2a)^3$ . (Give your answer in descending powers of  $z$ .)

The following symbols may be useful:  $a$ ,  $z$

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## Part C   $(a - b)^5$

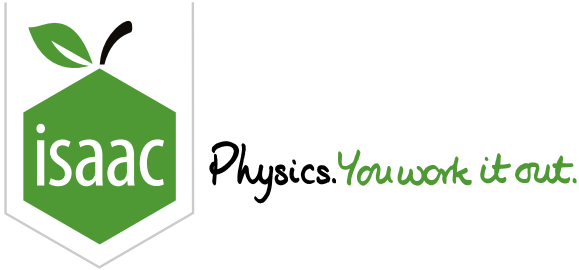
Expand and simplify  $(a - b)^5$ . (Give your answer in descending powers of  $a$ .)

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

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# Find coefficients 1

A Level

Further A

P

P

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P

P

Find the coefficient of  $x^3$  in the expansion of:

**Part A**      $(x - 10)^5$

$(x - 10)^5.$

**Part B**      $(2x - \frac{1}{2})^6$

$(2x - \frac{1}{2})^6$

**Part C**      $(x - y)^{10}$

$(x - y)^{10}.$

The following symbols may be useful:  $x$ ,  $y$

**Part D**      $(x - \frac{1}{x})^7$

$(x - \frac{1}{x})^7.$



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[Home](#) [Maths](#) [Algebra](#) [Series](#) [Find coefficients 2](#)

# Find coefficients 2

**A Level** **Further A**  







Without expanding the binomials, find:

## Part A Coefficient of $x^4y^6$

The coefficient of  $x^4y^6$  in the expansion of  $(x^2 + 3y^2)^5$ .

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## Part B Coefficient of $x^{20}$

The coefficient of  $x^{20}$  in the expansion of  $(x^2 + 3x)^{12}$ .

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## Part C The coefficient of $ab^7$

The coefficient of  $ab^7$  in the expansion of  $(a + \frac{1}{4}b)^8$ .

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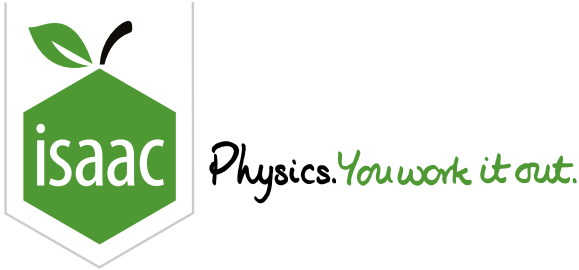
## Part D Constant term

The constant term in the expansion of  $(\frac{x^2}{2} - \frac{8}{x})^9$ .

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# Binomial Expansion 3

A Level   Further A

C

C

C

P

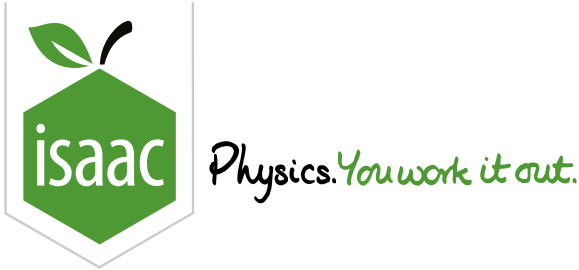
P

P

Expand  $(3 - a)^4$  in ascending powers of  $a$  up to and including the term in  $a^3$ . Hence, without using a calculator, evaluate  $(2.9)^4$  correct to 2 decimal places

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# Group and expand

A Level   Further A

C

C

C

P

P

P

Expand  $(1 - 2x + 3x^2)^7$  in ascending powers of  $x$  as far as  $x^3$ .

The following symbols may be useful:  $x$

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# Binomial: All Rational n 4ii

A Level

P

P

P

Part A

Expansion

Expand  $(2 + x)^{-2}$  in ascending powers of  $x$  up to and including the term in  $x^3$ .

The following symbols may be useful:  $x$

Part B

Set of Values

State the set of values of  $x$  for which the expression is valid. You may use the symbols  $<$   $>$   $=$   $x$  and  $|x|$  which can be entered as `abs(x)`.

The following symbols may be useful:  $<$ ,  $>$ , `abs()`,  $x$

Part C

Coefficient

Hence find the coefficient of  $x^3$  in the expansion of  $\frac{1+x^2}{(2+x)^2}$ .

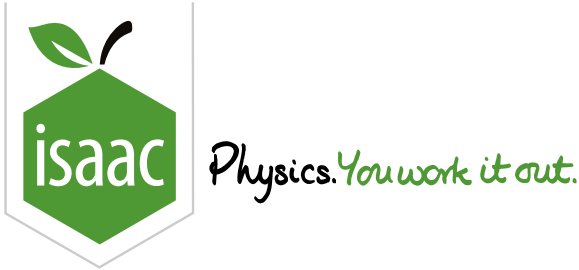
The following symbols may be useful:  $x$

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Gameboard:

**Pure Maths Practice: Binomial - All Rational n**

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# Binomial: All Rational n 4i

A Level

P

P

P

Part A

Expansion 1

Find the first three terms of in the expansion of  $(9 - 16x)^{\frac{3}{2}}$  in ascending powers of  $x$ .

The following symbols may be useful:  $x$

Part B    Expansion 1: Validity

Find the set of values for which the expansion in Part A is valid.

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

Part C    Expansion 2

Expand  $(1 + 3x)^{-\frac{5}{3}}$  in ascending powers of  $x$ , up to and including the term  $x^3$ .

The following symbols may be useful: x

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[Home](#) [Gameboard](#) [Maths](#) [Binomial: All Rational n 2i](#)

# Binomial: All Rational n 2i



## Part A Expansion

Expand  $(1 - 4x)^{\frac{1}{4}}$  in ascending powers of  $x$ , up to and including the term in  $x^3$ .

The following symbols may be useful:  $x$

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## Part B Values of $a$ and $b$

The term of lowest degree in the expansion of

$$(1 + ax)(1 + bx^2)^7 - (1 - 4x)^{\frac{1}{4}}$$

in ascending powers of  $x$  is the term  $x^3$ . Find the values of the constants  $a$  and  $b$ .

What is the value of  $a$ ?

The following symbols may be useful:  $a$

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What is the value of  $b$ ?

The following symbols may be useful:  $b$

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[Home](#) [Maths](#) [Algebra](#) [Series](#) [Maclaurin Series - Binomial](#)

# Maclaurin Series - Binomial

A Level Further A  
P P P P P P

## Part A Expand $(1 + r)^{1/3}$ and find $1.1^{1/3}$ and $9^{1/3}$

Expand  $(1 + r)^{1/3}$  up to the term in  $r^3$ .

The following symbols may be useful:  $r$

Hence find, without using a calculator,  $(1.1)^{1/3}$  to 3 decimal places.

Now find  $9^{1/3}$  without using a calculator to 2 decimal places.

## Part B Electric field on the axis of a charged sheet

The electric field  $E$  on the axis of a uniformly charged circular sheet at a distance  $z$  from the centre of the sheet is given by

$$E = \frac{\sigma}{2\epsilon_0} \left[ 1 - \frac{z}{\sqrt{z^2 + a^2}} \right]$$

where  $\sigma$  is the charge per unit area on the sheet and  $a$  is the radius of the sheet. Show that in the limit when  $z \gg a$  the field on the axis is such that  $E \approx A/z^2$  and find  $A$ .

The following symbols may be useful:  $A$ ,  $a$ ,  $\epsilon_0$ ,  $\sigma$ ,  $z$

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