Physics. *You work it out.*

Home   Gameboard   Maths   Binomial: All Rational n 2ii

Binomial: All Rational n 2ii

A Level

P P P

Part A   Expansion

Expand $(1 + 4x)^{\frac{1}{2}}$ in ascending powers of x, up to and including the term in x^2, simplifying the coefficients.

The following symbols may be useful: `x`

Part B   Values of x

State the set of values of x for which the expansion 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   Value of k

In the expansion of

$$(1 + kx)(1 + 4x)^{\frac{1}{2}},$$

the coefficient of x is 7. Find the value of the constant k and hence the coefficient of x^2.

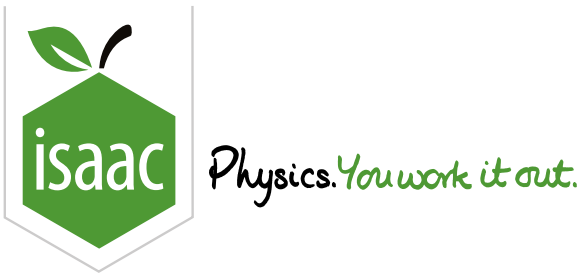State the value of k.

The following symbols may be useful: k

State the coefficient of x^2.

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isaac Physics. *You work it out.*

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

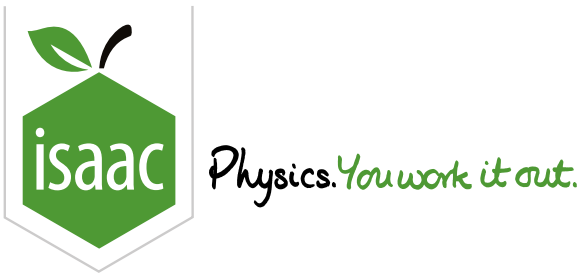Hence find the coefficient of x^3 in the expansion of $\frac{1+x^2}{(2+x)^2}$.

The following symbols may be useful: x

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Gameboard:

STEM SMART Single Maths 28 - Binomial Theorem - Rational n

Binomial: All Rational n 1i

A Level

P P P

Part A   Partial Fractions

Given that $\frac{3x+4}{(1+x)(2+x)^2} \equiv \frac{A}{1+x} + \frac{B}{2+x} + \frac{C}{(2+x)^2}$, find A, B, and C.

Find A.

The following symbols may be useful: A

Find B.

The following symbols may be useful: B

Find C.

The following symbols may be useful: C

Part B   Expand

Hence or otherwise expand $\frac{3x+4}{(1+x)(2+x)^2}$ in ascending powers of x, up to and including the term in x^2.

The following symbols may be useful: x

Part C   Values of x

State the set of values of x for which the expansion in the above part is valid.

Construct your answer from the items below.

Items:

x $<$ $\leq$ $>$ $\geq$ $< x <$ $\leq x \leq$ $> x$ **or** $x >$ $\geq x$ **or** $x \geq$ -4 -2 $-\frac{3}{2}$ -1

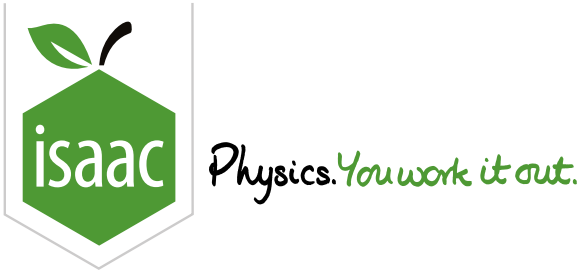$-\frac{1}{2}$ 0 $\frac{1}{2}$ 1 $\frac{3}{2}$ 2 4

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Gameboard:

STEM SMART Single Maths 28 - Binomial Theorem - Rational n

Binomial: All Rational n 3i

A Level

Find the coefficient of x^2 in the expansion in ascending powers of x of
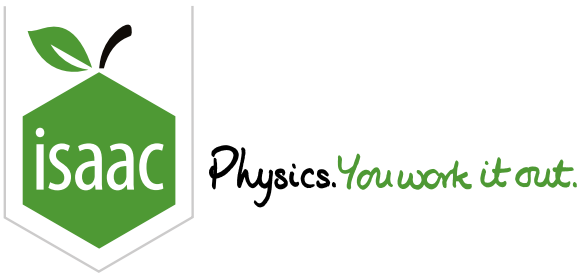
$$\sqrt{\frac{1 + ax}{4 - x}}$$

giving your answer in terms of a.

The following symbols may be useful: a

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Gameboard:

STEM SMART Single Maths 28 - Binomial Theorem - Rational n

Binomial Expansion 1

Pre-Uni Maths for Sciences 4.3.1

A Level   Further A

Rewrite each of the following expressions in the form $a(1+b)^n$, where $|b| < 1$. Hence, using the appropriate binomial expansion, find the value of each of them correct to 4 dp.

Part A $\sqrt{36.1}$

Rewrite $\sqrt{36.1}$ in the form $a(1+b)^n$, where $|b| < 1$ and $n = \frac{1}{2}$. Hence, using the appropriate binomial expansion, find the value correct to 4 dp.

Give the value of a.

Give the value of b as a simplified fraction.

Using the binomial theorem, evaluate $\sqrt{36.1}$ correct to 4 dp.

Part B $\sqrt[3]{1.09}$

Rewrite $\sqrt[3]{1.09}$ in the form $a(1+b)^n$, where $|b| < 1$ and $n = \frac{1}{3}$. Hence, using the appropriate binomial expansion, find the value correct to 4 dp.

Give the value of a.

Give the value of b as a simplified fraction.

Using the binomial theorem, evaluate $\sqrt[3]{1.09}$ correct to 4 dp.

Part C $1/\sqrt{1.04}$

Rewrite $\dfrac{1}{\sqrt{1.04}}$ in the form $a(1+b)^n$, where $|b| < 1$ and $n = -\frac{1}{2}$. Hence, using the appropriate binomial expansion, find the value correct to 4 dp.

Give the value of a.

Give the value of b as a simplified fraction.

Using the binomial theorem, evaluate $\dfrac{1}{\sqrt{1.04}}$ correct to 4 dp.

Part D $\sqrt[3]{125.4}$

Rewrite $\sqrt[3]{125.4}$ in the form $a(1+b)^n$, where $|b| < 1$ and $n = \frac{1}{3}$. Hence, using the appropriate binomial expansion, find the value correct to 4 dp.

Give the value of a.

Give the value of b as a simplified fraction.

Using the binomial theorem, evaluate $\sqrt[3]{125.4}$ correct to 4 dp.

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Gameboard:

STEM SMART Single Maths 28 - Binomial Theorem - Rational n

Binomial: All Rational n 5i

A Level

Part A   Expansion

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

The following symbols may be useful: x

Part B   Coefficient of x^3

Hence find the coefficient of x^3 in the expansion of $\left(1 - 3\left(x + x^3\right)\right)^{-\frac{1}{3}}$

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Gameboard:

STEM SMART Single Maths 28 - Binomial Theorem - Rational n

Maclaurin Series – Potential due to Dipole

Further A University

Pre-Uni Maths for Sciences C3.9

Part A   Potential on the axis

An electric dipole consists of two charges $+q$ and $-q$ separated in the z direction by a very small distance a. The electric potential $V(z)$ a distance z away from the centre of the dipole in a direction along the line joining the two charges is given by

$$V(z) = \frac{q}{4\pi\epsilon_0} \left(\frac{1}{z - \frac{a}{2}} - \frac{1}{z + \frac{a}{2}} \right).$$

Find an approximate expression for $V(z)$ (assume that $z \gg a$ and obtain the first non-zero term in the Maclaurin (or binomial) expansion of $V(z)$).

The following symbols may be useful: `a, epsilon_0, pi, q, z`

Part B   Potential in any direction

An electric dipole consists of two charges $+q$ and $-q$ separated by a distance a. The electric potential V a distance r from the centre of the dipole in a direction making an angle θ to the line joining the two charges is given approximately by

$$V \approx \frac{q}{4\pi\epsilon_0} \left(\frac{1}{\sqrt{r^2 - ar\cos\theta}} - \frac{1}{\sqrt{r^2 + ar\cos\theta}} \right).$$

Assuming that $r \gg a$ show that $V \approx \dfrac{A\cos\theta}{r^2}$ and find an expression for A.

The following symbols may be useful: `a, epsilon_0, pi, q, r`