4.1.13 - The Binomial Theorem II

4.1 - Algebra - Expressions

Leaving Certificate Mathematics

Higher Level ONLY

The Binomial Theorem

The Binomial Theorem

The **Binomial Theorem** tells us that:

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x + y)^n \quad =$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x+y)^n \quad = \quad \binom{n}{0}$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x+y)^n = \binom{n}{0}x^n$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x+y)^n \quad = \quad \binom{n}{0}x^n y^0$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x+y)^n = \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x+y)^n \quad = \quad \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1 + \binom{n}{2}x^{n-2}y^2$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$
\begin{aligned}
(x+y)^n \quad = \quad & \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1 + \binom{n}{2}x^{n-2}y^2 + \dots \\
& \dots \quad + \binom{n}{r}x^{n-r}y^r
\end{aligned}
$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$\begin{aligned}(x+y)^n &= \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1 + \binom{n}{2}x^{n-2}y^2 + \ldots \\ \ldots &+ \binom{n}{r}x^{n-r}y^r + \ldots + \binom{n}{n-1}x^1 y^{n-1}\end{aligned}$$

The Binomial Theorem

The **Binomial Theorem** tells us that:

$$(x+y)^n = \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1 + \binom{n}{2}x^{n-2}y^2 + \dots$$
$$\dots + \binom{n}{r}x^{n-r}y^r + \dots + \binom{n}{n-1}x^1 y^{n-1} + \binom{n}{n}x^0 y^n$$

Example 1

Example 1

Q. Expand $(2x-3)^4$.

Example 1

Q. Expand $(2x - 3)^4$.

Answer:

Example 1

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$$(2x-3)^4 \quad =$$

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Answer:

$$(2x-3)^4 = \binom{4}{0}(2x)^4(-3)^0$$

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Answer:

$$(2x-3)^4 = \binom{4}{0}(2x)^4(-3)^0 + \binom{4}{1}(2x)^3(-3)^1$$

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Q. Expand $(2x-3)^4$.

Answer:

$$(2x-3)^4 = \binom{4}{0}(2x)^4(-3)^0 + \binom{4}{1}(2x)^3(-3)^1 + \binom{4}{2}(2x)^2(-3)^2$$

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Q. Expand $(2x-3)^4$.

Answer:

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\begin{aligned}
(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0 + \binom{4}{1}(2x)^3(-3)^1 + \binom{4}{2}(2x)^2(-3)^2 + \dots \\
&\dots + \binom{4}{3}(2x)^1(-3)^3
\end{aligned}
$$

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\ldots &+ \binom{4}{3}(2x)^1(-3)^3 + \binom{4}{4}(2x)^0(-3)^4
\end{aligned}
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(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0 + \binom{4}{1}(2x)^3(-3)^1 + \binom{4}{2}(2x)^2(-3)^2 + \dots \\
\dots &\quad + \binom{4}{3}(2x)^1(-3)^3 + \binom{4}{4}(2x)^0(-3)^4 \\
&= 1(16x^4)(1)
\end{aligned}
$$

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$$\begin{aligned}(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0+\binom{4}{1}(2x)^3(-3)^1+\binom{4}{2}(2x)^2(-3)^2+\ldots \\ \ldots &\quad +\binom{4}{3}(2x)^1(-3)^3+\binom{4}{4}(2x)^0(-3)^4 \\ &= 1(16x^4)(1)+4(8x^3)(-3)\end{aligned}$$

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\begin{aligned}
(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0 + \binom{4}{1}(2x)^3(-3)^1 + \binom{4}{2}(2x)^2(-3)^2 + \ldots \\
\ldots &\quad + \binom{4}{3}(2x)^1(-3)^3 + \binom{4}{4}(2x)^0(-3)^4 \\
&= 1(16x^4)(1) + 4(8x^3)(-3) + 6(4x^2)(9)
\end{aligned}
$$

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$$\begin{aligned}(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0+\binom{4}{1}(2x)^3(-3)^1+\binom{4}{2}(2x)^2(-3)^2+\ldots\\ \ldots &\quad +\binom{4}{3}(2x)^1(-3)^3+\binom{4}{4}(2x)^0(-3)^4\\ &= 1(16x^4)(1)+4(8x^3)(-3)+6(4x^2)(9)+4(2x)(-27)\end{aligned}$$

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(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0 + \binom{4}{1}(2x)^3(-3)^1 + \binom{4}{2}(2x)^2(-3)^2 + \dots \\
\dots & \quad + \binom{4}{3}(2x)^1(-3)^3 + \binom{4}{4}(2x)^0(-3)^4 \\
&= 1(16x^4)(1) + 4(8x^3)(-3) + 6(4x^2)(9) + 4(2x)(-27) + \dots \\
\dots & \quad +1(1)(81) \\
&= 16x^4
\end{aligned}
$$

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Q. Expand $(2x-3)^4$.

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$$\begin{aligned}(2x-3)^4 &= \binom{4}{0}(2x)^4(-3)^0+\binom{4}{1}(2x)^3(-3)^1+\binom{4}{2}(2x)^2(-3)^2+\dots\\ \dots &\quad +\binom{4}{3}(2x)^1(-3)^3+\binom{4}{4}(2x)^0(-3)^4\\ &= 1(16x^4)(1)+4(8x^3)(-3)+6(4x^2)(9)+4(2x)(-27)+\dots\\ \dots &\quad +1(1)(81)\\ &= 16x^4-96x^3\end{aligned}$$

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\dots &\quad + \binom{4}{3}(2x)^1(-3)^3 + \binom{4}{4}(2x)^0(-3)^4 \\
&= 1(16x^4)(1) + 4(8x^3)(-3) + 6(4x^2)(9) + 4(2x)(-27) + \dots \\
\dots &\quad +1(1)(81) \\
&= 16x^4 - 96x^3 + 216x^2
\end{aligned}$$

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&= 1(16x^4)(1) + 4(8x^3)(-3) + 6(4x^2)(9) + 4(2x)(-27) + \ldots \\
\ldots &\quad +1(1)(81) \\
&= 16x^4 - 96x^3 + 216x^2 - 216x
\end{aligned}
$$

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&= 1(16x^4)(1) + 4(8x^3)(-3) + 6(4x^2)(9) + 4(2x)(-27) + \ldots \\
\ldots &\quad +1(1)(81) \\
&= 16x^4 - 96x^3 + 216x^2 - 216x + 81
\end{aligned}$$