MATHS

BOOKS - CENGAGE

PRINCIPLE OF MATHEMATICAL INDUCTION

Examples

1. Find the derivative of $y = 3\sin 4x + 5\cos 2x^3$.

2.

$$1 + \frac{1}{(1+2)} + \frac{1}{(1+2+3)} + \dots . + \frac{1}{(1+2+3+\dots n)} = \frac{2n}{(n+1)}$$

3. Prove that by using the principle of mathematical induction for all $n \in N$:

$$1.3 + 2.3^2 + 3.3.^3 + ... + n.3^n = \frac{(2n-1)3^{n+1} + 3}{4}$$

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4. Prove that by using the principle of mathematical induction for all $n \in N$:

$n(n+1)(n+5)$ is a multiple of 3

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5. Prove that by using the principle of mathematical induction for all $n \in N$:

$3^{2n+2} - 8n - 9$ is divisible by 8

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6. Prove that by using the principle of mathematical induction for all $n \in N$:

$41^n - 14^n$ is multiple of 27

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7. Prove that by using the principle of mathematical induction for all $n \in N$:

$(2n + 7) < (n + 3)^2$

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8. Evaluate $\int \frac{2x^3 - 1}{x^4 + x} dx$

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9. A sequence $a_1, a_2, a_3, \ldots$ is defined by letting $a_1 = 3$ and $a_k = 7a_{k-1}$, for all natural numbers $k \leq 2$. Show that $a_n = 3 \cdot 7^{n-1}$ for natural numbers.

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10. Find the L.C.M. of the given expressions $2p^2 - 3p - 2, p^2 - 9.$

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11. Evaluate $\int \frac{2x - 3}{x^2 - 3x + 5} dx$

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12. If p is a fixed positive integer, prove by induction that $p^{n+1} + (p+1)^{2n-1}$ is divisible by $P^2 + p + 1$ for all $n \in N$.

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13. Evaluate $\int \frac{x-1}{x^2-2x-35}dx$

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Exercise

1. Prove that by using the principle of mathematical induction for all $n \in N$:

$$1.3+3.5+5.7+\ldots.+(2n-1)(2n+1)=\frac{n(4n^2+6n-1)}{3}$$

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2. Using the mathematical induction, show that for any natural number n,

$$\frac{1}{1.2.3}+\frac{1}{2.3.4}+\frac{1}{3.4.5}+\ldots+\frac{1}{n.(n+1).(n+2)}=\frac{n(n+3)}{4(n+1)(n+2)}$$

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3. By mathematical induction prove that 2^{3n}-1 is divisible by 7.

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4. Evaluate $\int \frac{2x-5}{x^2-5x+6}dx$

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5. Using principle of mathematical induction prove that $\sqrt{n} < \frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \ldots\ldots + \frac{1}{\sqrt{n}}$ for all natural numbers $n \geq 2$

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6. Prove by the principle of mathematical induction that $\frac{n^5}{5} + \frac{n^3}{3} + \frac{7n}{15}$ is a natural number for all $n \in N$.

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7. Using principle of mathematical induction, prove that $7^{4^n} - 1$ is divisible by 2^{2n+3} for any natural number n.

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8. Prove by mathematical induction that n^5 and n have the same unit digit for any natural number n.

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9. A sequence $b_0, b_1, b_2, \ldots$ is defined by letting $b_0 = 5$ and $b_k = 4 + b_{k-1}$, for all natural number k. Show that $b_n = 5 + 4n$, for all natural number n using mathematical induction.

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