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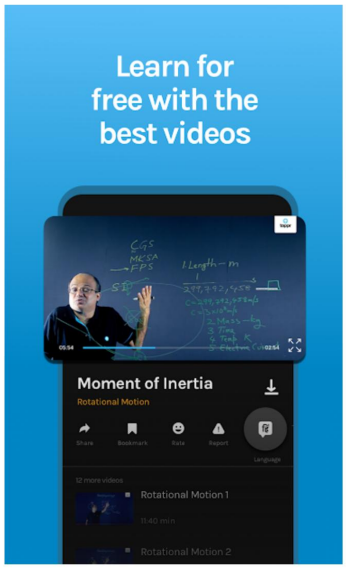

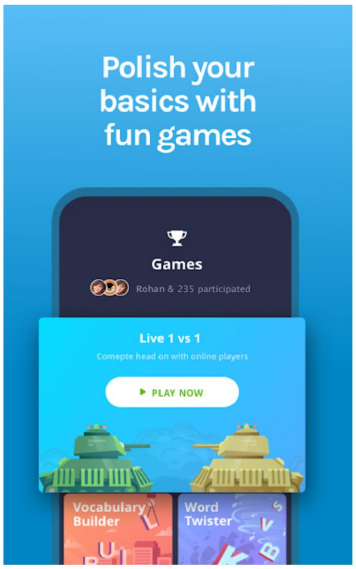

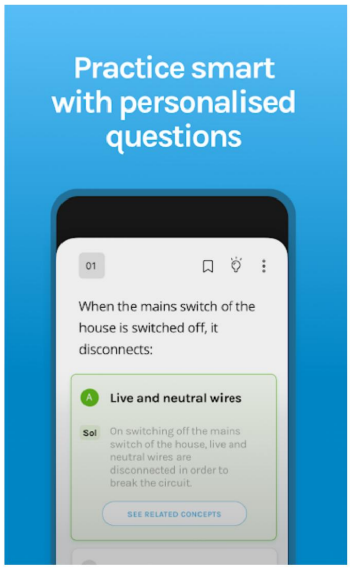

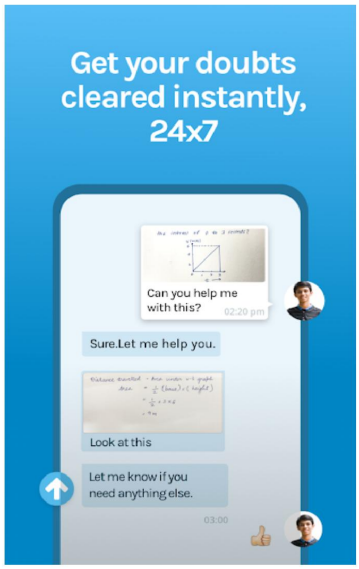

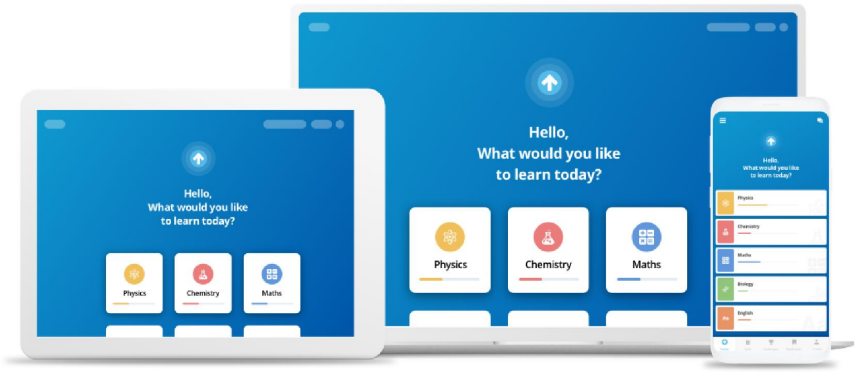

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#459550

Topic: Principle of Mathematical Induction

Using mathematical induction, prove that $\frac{d}{dx}(x^n) = nx^{n-1}$ for all positive integers n.

Solution

Check the given expression for $n = 1$

L.H.S. $= \frac{d}{dx}(x^1) = \frac{dx}{dx} = 1$

R.H.S. $= 1.x^{1-1} = 1$

Hence, it is true for $n = 1$

Let the expression be true for $n = k$

$\frac{d}{dx}(x^k) = kx^{k-1}$

Now, check for $n = k + 1$

L.H.S. $= \frac{d}{dx}(x^{k+1}) = \frac{d}{dx}(x^k . x) = x\frac{d}{dx}(x^k) + x^k\frac{d}{dx}(x)$

$= x(kx^{k-1}) + x^k(1) = kx^k + x^k$

$= (k + 1)x^k = (k + 1)x^{(k+1)-1}$

Hence, the given expression is true for $n = k + 1$ too.

By principle of mathematical induction, $\frac{d}{dx}(x^n) = nx^{n-1}$