Divisibility Tests by Induction

Ex Prove by induction

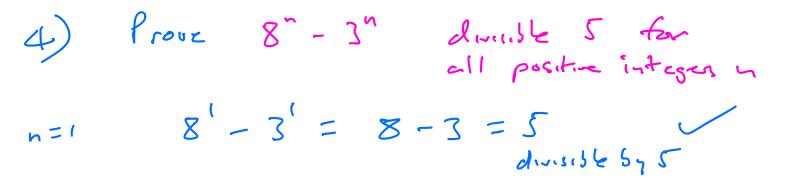
$$n^{3} - 7n + 9$$
 is divisible by 3 for all
the integers
 $n = 1$ $1^{3} - 7(1) + 9 = 3$ divisible by 3
Assume true for $n = 4$
 $\therefore 4^{3} - 747 + 9 = 34$ for some
integer 4
Consider $n = 471$

then
$$(k+1)^3 - 7(k+1) + 9$$

= $k^3 + 3k^2 + 3k + 1 - 7k - 7 + 9$
= $k^3 - 7k + 9 + 3k^2 + 3k - 7 + 1$
= $3k + 3k^2 + 3k - 6$
= $3(k + k^2 + k - 2)$
uliul is divisible by 3 since 3 is a factor
i if formula true for $n = k$, also true
for $n = k + 1$. Since true for $n = (1, 6)$
mothematical induction it is true for all
positive integes n

Exercise 8B

6)
$$Prove 2^{6n} + 3^{2n-2}$$
 is divisible by 5
 $n=1$ $2^{6} + 3^{9} = (4+1) = 65$ divisible by 5
Trole for $n=1$
Associe frive for $n=k$
then $2^{6k} + 3^{2k-2} = 5h$ for some
integrich
Consider $n = k+1$
 $2^{6(k+1)} + 3^{2(k+1)-2}$
 $= 2^{6k} \times 2^{6} + 3^{2k+2-2}$
 $= 64 \times 2^{6k} + 9 \times 3^{2k-2}$
 $= 55 \times 2^{6k} + 9 (2^{6k} + 3^{2k-2})$
 $= 55 \times 2^{6k} + 9 (5k)$
 $= 5 (11 \times 2^{6k} + 9k)$ (11 × 2^{6k} + 9k)
 $= 5 (11 \times 2^{6k} + 9k)$ (11 × 2^{6k} + 9k)
 $= 5 (11 \times 2^{6k} + 9k)$ (11 × 2^{6k} + 9k)
 $= 5 \sin e$ fixed for $n = k$, true the $n = k+1$
 $e = k+1$



Consider h= K+1

$$8^{K+1} - 3^{K+1} = 8 \cdot 8^{K} - 3 \cdot 3^{K}$$

= $5 \cdot 8^{K} + 3 \cdot 8^{K} - 3 \cdot 3^{K}$
= $5 \cdot 8^{K} + 3(8^{K} - 3^{K})$
= $5 \cdot 8^{K} + 3(5L)$
= $5(8^{K} + 3L)$
divisible by 5
: if fore finance also true for an expl
etc

Huk: Spend an hour on Enercise 8B