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If you chose to fail, no one can stop you!

Self - Exercise 12

Let P(n) be the statement

1. $1 + 2 + 3 + 4 + \dots + n = \frac{n(n+1)}{2}$

a) What is the statement P(0)?

$P(0) : 0 = \frac{0(0+1)}{2}$

b) Show that P(1) is true

$P(1) : 1 = \frac{1(1+1)}{2}$

$1 = \frac{1(2)}{2}$

$1 = \frac{2}{2}$

$1 = 1$

you need to state this!

Since both sides with the same value, so P(1) is true.

c) Complete the inductive step

$1 + 2 + 3 + 4 + \dots + k + \frac{k(k+1)}{2} (k+1)$

$= \frac{k(k+1) + 2(k+1)}{2}$

$= \frac{(k+1)[k + 2(k+1)]}{2}$

$= \frac{(k+1)(k + 2k + 2)}{2}$

$= \frac{(k+1)(k+1)}{2}$

$= \frac{k(k+1)}{2} + (k+1)$

$= \frac{k(k+1)}{2} + \frac{2(k+1)}{2}$

$= \frac{k(k+1) + 2(k+1)}{2}$

$= \frac{k^2 + k + 2k + 2}{2}$

$= \frac{k^2 + 3k + 2}{2}$

$= \frac{(k+2)(k+1)}{2}$

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2. A recurrence relation is given as $a_n = a_{n-2} + a_{n-1}$ where $n \geq 2$, $a_0 = 7$ and $a_1 = 13$. Find a_2, a_3, a_4 and a_5.

$a_0 = 7$, $a_1 = 13$

$a_n = a_{n-2} + a_{n-1}$

$a_2 = a_{1-2} + a_{1-1}$
$= a_1 + a_0$
$= 13 + 7$
$= 20$

wrong!

$a_2 = a_{2-2} + a_{2-1}$
$= a_0 + a_1$
$= 7 + 13$
$= 20$.

$a_3 = a_{2-2} + a_{2-1}$
$= a_0 + a_1$
$= 7 + 13$
$= 20$

$a_3 = a_{3-2} + a_{3-1}$
$= a_1 + a_2$
$= 13 + 20$
$= 33$.

What happened?

$a_4 = a_{3-2} + a_{3-1}$
$= a_1 + a_2$
$= 13 + 20$
$= 33$

$a_4 = a_{4-2} + a_{4-1}$
$= a_2 + a_3$
$= 20 + 33$
$= 53$.

$a_5 = a_{4-2} + a_{4-1}$
$= a_2 + a_3$
$= 20 + 20$
$= 40$

$a_5 = a_{5-2} + a_{5-1}$
$= a_3 + a_4$
$= 33 + 53$
$= 86$.

Yolanda — please ask if you don't know!

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3. Function f is defined recursively by $f(0) = 1$ and $f(n+1) = 2f(n) - f(n)^2 - 2$ for $n \geq 0$. Find $f(3) + f(4)$.

$$f(0+1) = 2f(0) - f(0)^2 - 2$$
$$f(1) = 2(1) - (1)^2 - 2$$
$$= 2 - 1 - 2$$
$$= -1$$

$$f(1) = f(0+1)$$
$$= 2f(0) - f(0)^2$$
$$= 2(1) - 1^2$$
$$= 2 - 1 = 1$$

$$f(1+1) = 2f(1) - f(1)^2 - 2$$
$$f(2) = 2(-1) - (-1)^2 - 2$$
$$= -2 - 1 - 2$$
$$= -5$$

$$f(2) = f(1+1)$$
$$= 2f(1) - f(1)^2$$
$$= 2(1) - 1^2$$
$$= 2 - 1 = 1$$

$$f(2+1) = 2f(2) - f(2)^2 - 2$$
$$f(3) = 2(-5) - (-5)^2 - 2$$
$$= -10 - 25 - 2$$
$$= -37$$

$$f(3) = f(2+1)$$
$$= 2f(2) - f(2)^2$$
$$= 2(1) - 1^2$$
$$= 2 - 1 = 1$$

$$f(3+1) = 2f(3) - f(3)^2 - 2$$
$$f(4) = 2(-37) - (-37)^2 - 2$$
$$= -74 - 1369 - 2$$
$$= -1445$$

$$f(4) = f(3+1)$$
$$= 2f(3) - f(3)^2$$
$$= 2(1) - 1^2$$
$$= 2 - 1$$
$$= 1$$

So, $f(3) + f(4) = 1 + 1 = 2$.