Sample Homework in Latex

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January 12, 2016

Problem 1

Description of the problem.

Solution

This is a simple paragraph.

Two linefeeds in a row make a new paragraph. We can inline math: Let $f_n = 3n^2 + 2n - 17$

We can put math in its own block:

$$\begin{gathered}
\text{Let } n = 5. \text{ Substituting:} \\
f(5) = 3(5)^2 + 2(5) - 17 \\
f(5) = 3 * 25 + 10 - 17 \\
\text{So, of course:} \\
f(5) = 68
\end{gathered}$$

We can get the equals signs to line up:

$$\begin{aligned}
\text{Let } n = 5. \text{ Substituting:} & & \\
f(5) &= 3(5)^2 + 2(5) - 17 \\
&= 3 * 25 + 10 - 17 \\
\text{And, here's text:} & & \\
f(5) &= 68
\end{aligned}$$

Problem 2

Part a

Here are some sums you'd better have stuck in your head

Solution

$$\begin{aligned}
\sum_{i=a}^{b} r &= (b-a+1)r && (1)\\
\sum_i c(f_i) &= c\sum_i (f_i) && (2)\\
\text{For some big parens:} & && (3)\\
\sum_i (f_i+g_i) &= \left(\sum_i f_i + \sum_i g_i\right) && (4)\\
\sum_{i=1}^{m} i &= \frac{m(m+1)}{2} && (5)\\
\sum_{i=1}^{m} i^2 &= \frac{m(m+1)(2m+1)}{6} && (6)\\
\sum_{i=0}^{m} ar^i, r \neq 1 &= a\frac{r^{m+1}-1}{r-1} && (7)\\
\sum_{i=0}^{\infty} ar^i, 0<|r|<1 &= a\frac{1}{1-r} && (8)
\end{aligned}$$

Part b

Here are some logs you'd better have stuck in your head

Solution

$$\begin{aligned}
\log_b 1 &= 0 && (9)\\
\log_b b &= 1 && (10)\\
\log_b (xy) &= \log_b x + \log_b y && (11)\\
\log_b \frac{x}{y} &= \log_b x - \log_b y && (12)\\
\log_b x^n &= n\log_b x && (13)
\end{aligned}$$

Problem 3

Here's a definition of Fibonacci numbers

Solution

$$F_n = \begin{cases} F_{n-1}+F_{n-2} & ,n>1\\ 1 & ,n=0 \\ 1 & ,n=1 \end{cases}$$

Problem 4

And tables are pretty easy. & separates columns, and \\ is a newline in Latex

Solution

Name	n	$(3/2)^n$
Picard	0	1
Riker	1	1.5
Worf	2	2.25
Troi	3	3.375
Crusher	4	5.0625
LaForge	5	7.59375
O'Brien	6	11.390625
Guinan	7	17.0859375
Q	8	25.62890625

We can get the decimals to line up:

Name	n	$(3/2)^n.$
Picard	0	1.
Riker	1	1.5
Worf	2	2.25
Troi	3	3.375
Crusher	4	5.0625
LaForge	5	7.59375
O'Brien	6	11.390625
Guinan	7	17.0859375
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Problem 5

Show the following statements:

Part a

$3n + 7 \in \mathrm{O}(n^2)$

Solution

By the definition, we need to find a $c > 0$ and $n_0 > 0$ such that $cn^2 \geq 3n + 7, \forall n > n_0$:

$$\begin{aligned} 3n + 7 &\leq 3n^2 + 7n^2, \forall n \geq 1 \\ &= 10n^2 \\ \text{So, we have} & \\ 10n^2 &\geq 3n + 7, \forall n > 1 \end{aligned}$$

We have our 2 witnesses.