FJ started a 30 day treatment program which involved daily injections of a medication. The first day's injection **SCORE: _____ / 5 PTS**
was 12 mg, and each subsequent day's injection was 5% less than the previous day's injection. Find the total amount of the injections.
Your final answer may **NOT** use ... **NOR** $\sum$. It may use $+$, $-$, $\times$, $\div$ and powers. (It does **NOT** need to be simplified into a single number.)

a_n = AMOUNT OF INJECTION ON n^{TH} DAY

$a_1 = 12$

$a_2 = 12(1-0.05) = 12(0.95)$

$a_3 = 12(0.95)^2$

$\vdots$

$a_n = 12(0.95)^{n-1}$

1 $\quad$ $2\frac{1}{2}$

$$\text{TOTAL} = \frac{12\left(1-0.95^{30}\right)}{1-0.95}$$

$1\frac{1}{2}$

Use Pascal's Triangle to expand and simplify $(n^3 - 2r^4)^5$. **SCORE: _____ / 5 PTS**

$$(n^3)^5 + 5(n^3)^4(-2r^4) + 10(n^3)^3(-2r^4)^2 + 10(n^3)^2(-2r^4)^3 + 5(n^3)(-2r^4)^4 + (-2r^4)^5$$

$$= \underbrace{n^{15}}_{\frac{1}{2}} \underbrace{-10n^{12}r^4}_{1} \underbrace{+40n^9r^8}_{1} \underbrace{-80n^6r^{12}}_{1} \underbrace{+80n^3r^{16}}_{1} \underbrace{-32r^{20}}_{\frac{1}{2}}$$

Using the formulae for the sums of the powers of integers in your textbook, find the sum $\sum_{n=1}^{240}(2-5n+3n^2)$. **SCORE: _____ / 4 PTS**

Your final answer may **NOT** use ... **NOR** $\sum$. It may use $+, -, \times, \div$. (It does **NOT** need to be simplified into a single number.)

$$\sum_{n=1}^{240} 2 - 5\sum_{n=1}^{240} n + 3\sum_{n=1}^{240} n^2$$

$$= \underbrace{240 \cdot 2}_{\frac{1}{2}} \underbrace{- 5 \cdot \frac{240(241)}{2}}_{1\frac{1}{2}} \underbrace{+ 3 \cdot \frac{240(241)(481)}{6}}_{2}$$

Use mathematical induction to prove that is 3 a factor of $n^3 + 6n^2 + 5n$ for all positive integers n. **SCORE: _____ / 10 PTS**

BASIS STEP: 3 IS A FACTOR OF $1^3 + 6(1)^2 + 5(1) = 12$ 1

MUST HAVE WORD "INTEGER"

INDUCTIVE STEP: 1 ASSUME 3 IS A FACTOR OF $k^3 + 6k^2 + 5k$

FOR SOME PARTICULAR BUT ARBITRARY INTEGER 1 k 1 ≥ 1

[PROVE 3 IS A FACTOR OF $(k+1)^3 + 6(k+1)^2 + 5(k+1)$]

$(k+1)^3 + 6(k+1)^2 + 5(k+1)$ 1

$= k^3 + 3k^2 + 3k + 1$
$\quad + 6k^2 + 12k + 6$
$\quad + 5k + 5$

$= (k^3 + 6k^2 + 5k) + (3k^2 + 15k + 12)$

$= (k^3 + 6k^2 + 5k) + 3(k^2 + 5k + 4)$ 2

SINCE 3 IS A FACTOR OF BOTH $(k^3 + 6k^2 + 5k)$ AND $3(k^2 + 5k + 4)$ 1

THEREFORE 3 IS A FACTOR OF $(k+1)^3 + 6(k+1)^2 + 5(k+1)$ 1

SO, 3 IS A FACTOR OF $n^3 + 6n^2 + 5n$ $\frac{1}{2}$

FOR ALL INTEGERS $n \geq 1$ $\frac{1}{2}$

Find the rational number representation of the repeating decimal $0.2\overline{63}$ using the method discussed in lecture. **SCORE: _____ / 6 PTS**

NOTE: Only the 63 is repeated.

$$\underline{0.2 + 0.063 + 0.00063 + 0.0000063 + \ldots}$$ (1)

$$= \frac{2}{10} + \frac{0.063}{1 - \frac{1}{100}}$$

$$= \frac{2}{10} + \boxed{\frac{\frac{63}{1000}}{\frac{99}{100}}}$$ ($2\frac{1}{2}$)

$$= \frac{2}{10} + \frac{\overset{7}{63}}{10\cancel{00}} \cdot \frac{\cancel{100}}{\underset{11}{99}}$$

($\frac{1}{2}$) $$= \boxed{\frac{2}{10}} + \boxed{\frac{7}{110}}$$ (1)

$$= \boxed{\frac{29}{110}}$$ (1)