PROBLEMS AND SOLUTIONS - SEQUENCES AND SERIES
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PLEASE NOTE THAT YOU CANNOT ALWAYS USE A CALCULATOR ON THE ACCUPLACER - COLLEGE-LEVEL MATHEMATICS TEST! YOU MUST BE ABLE TO DO SOME PROBLEMS WITHOUT A CALCULATOR!

Problem 1:

Write the first four terms of the sequence $\{a_n\} = \left\{\frac{n-1}{n}\right\}$.

Problem 2:

Write the first three terms of the sequence $\{a_n\} = \{n^2(n+1)\}$.

Problem 3:

Show that the sequence $\{s_n\} = \{3n + 5\}$ is arithmetic.

Problem 4:

Show that the sequence $\{s_n\} = \{3^n\}$ is geometric.

Problem 5:

Write out the series $\sum_{j=1}^{3}(2^j + 1)$ and find the sum.

Problem 6:

Write out the series $\sum_{i=1}^{3} 6i$ and find the sum.

Problem 7:

Write out the series $\sum_{i=1}^{3} 6$ and find the sum.

Problem 8:

Evaluate ***5!***.

Problem 8:

Evaluate ***5!***.

Problem 9:

Write ***11!*** as ***n(n - 1)!***

Problem 10:

Evaluate $\frac{9!}{8!}$.

Problem 11:

Evaluate $\frac{3!7!}{4!}$.

Problem 12:

Evaluate ***6! - 5!***.

SOLUTIONS
You can find detailed solutions below the link for this problem set!

Problem 1:

$$a_1 = \frac{1-1}{1} = 0,\quad a_2 = \frac{2-1}{2} = \frac{1}{2},\quad a_3 = \frac{3-1}{3} = \frac{2}{3},\quad a_4 = \frac{4-1}{4} = \frac{3}{4}$$

Problem 2:

$$a_1 = 1^2(1+1) = 2,\quad a_2 = 2^2(2+1) = 12,\quad a_3 = 3^2(3+1) = 36$$

Problem 3:

Show that the sequence $\{s_n\} = \{3n + 5\}$ is arithmetic.

This is what we do. We'll write out the first 5 terms as well as the last two terms ***{3(n - 1) + 5}*** and ***{3n + 5}***.

8, 11, 14, 17, 20, ... , 3(n - 1) + 5, 3n + 5

We can immediately see that the difference between the first five terms is ***3***. All that's left to do is make sure that the difference between the last two terms is also 3.

That is, $(3n + 5) - [3(n - 1) + 5] =$

$3n + 5 - (3n - 3 + 5) =$

$3n + 5 - 3n + 3 - 5 =$

3

This establishes the proof that the difference between successive terms is 3 and we do have an arithmetic sequence!

Problem 4:

Show that the sequence $\{s_n\} = \{3^n\}$ is geometric.

Again, we'll write out the first 5 terms as well as the last two terms $\{3^{n-1}\}$ and $\{3^n\}$.

$3, 9, 27, 81, 243, \ldots, 3^{n-1}, 3^n$

Looking at the first five terms, we can immediately see that the ratio of successive terms is ***3***. All that's left to do is make sure that the ration of the last two terms is also 3.

That is,

$$\frac{3^n}{3^{n-1}} = 3^{n-(n-1)} = 3$$

This establishes the proof that the ratio of successive terms is 3 and we do have a geometric sequence!

Problem 5:

$$\sum_{j=1}^{3}(2^j + 1) = (2^1 + 1) + (2^2 + 1) + (2^3 + 1) = 3 + 5 + 9 = 17$$

Problem 6:

$$\sum_{i=1}^{3} 6i = 6(1) + 6(2) + 6(3) = 6 + 12 + 18 = 36$$

Problem 7:

$$\sum_{i=1}^{3} 6 = 6 + 6 + 6 = 18$$

Problem 8:

$5(4)(3)(2)(1) = 120$

Problem 8:

$5(4)(3)(2)(1) = 120$

Problem 9:

$11 \cdot 10!$

Problem 10:

$$\frac{9 \cdot 8!}{8!} = 9$$

Problem 11:

$$\frac{3!(7)(6)(5) \cdot 4!}{4!} = 3(2)(1)(7)(6)(5) = 1260$$

Problem 12:

$(5)(5)(4)(3)(2)(1) = 600$