

Find the value of  $\sum_{k=6}^9 (-1)^{k-1} (k^2 - (k-5)!)$ .

SCORE: \_\_\_\_ / 5 PTS

$$= (-1)^5 (6^2 - 1!) + (-1)^6 (7^2 - 2!) + (-1)^7 (8^2 - 3!) + (-1)^8 (9^2 - 4!)$$

$$= -(36 - 1) + (49 - 2) - (64 - 6) + (81 - 24)$$

$$= \begin{array}{cccc} \textcircled{1} & \textcircled{1} & \textcircled{1} & \textcircled{1} \\ -35 & +47 & -58 & +57 \end{array}$$

$$= \underline{11} \textcircled{1}$$

Write  $\frac{5^2}{192} - \frac{6^2}{96} + \frac{7^2}{48} - \frac{8^2}{24} + \frac{9^2}{12} - \frac{10^2}{6}$  using sigma notation.

SCORE: \_\_\_\_ / 4 PTS

$\frac{96}{192} = \frac{1}{2}$   $\ast \frac{1}{2}$   $\ast \frac{1}{2}$   $\ast \frac{1}{2}$   $\ast \frac{1}{2}$   $\ast \frac{1}{2}$  GEOMETRIC SEQUENCE  
 $r = \frac{1}{2}$

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$$\sum_{i=1}^6 (-1)^{i+1} \frac{(i+4)^2}{192 \left(\frac{1}{2}\right)^{i-1}} \quad \text{OR} \quad \sum_{i=1}^6 \frac{(i+4)^2}{192 \left(-\frac{1}{2}\right)^{i-1}} \quad \text{OR} \quad \sum_{i=1}^6 \frac{(-2)^{i-1} (i+4)^2}{192}$$

Find the sum of the first 20 terms of the series  $\frac{9}{4} + \frac{11}{6} + \frac{17}{12} + 1 + \dots$ .

SCORE: \_\_\_\_ / 4 PTS

$$\frac{11}{6} - \frac{9}{4} = \frac{22-27}{12} = -\frac{5}{12}$$

$$\frac{17}{12} - \frac{11}{6} = \frac{17-22}{12} = -\frac{5}{12}$$

$$1 - \frac{17}{12} = \frac{12-17}{12} = -\frac{5}{12}$$

ARITHMETIC SERIES

$$d = -\frac{5}{12}$$

$$S_{20} = \frac{1}{2}(20)(2(\frac{9}{4}) + 19(-\frac{5}{12}))$$

$$= 10(\frac{9}{2} - \frac{95}{12})$$

$$= 10(\frac{54-95}{12})$$

$$= 10(\frac{-41}{12}) = -\frac{205}{6}$$

Simplify  $\frac{(n-3)!}{(n-6)!}$ . **NOTE: Your final answer can be in factored form.**

SCORE: \_\_\_\_\_ / 3 PTS

$$\boxed{\frac{(n-3)(n-4)(n-5)(n-6)!}{(n-6)!}} = \frac{(n-3)(n-4)(n-5)}{1\frac{1}{2}}$$

Find the 6<sup>th</sup> term of the sequence defined recursively by  $a_1 = 1$ ,  $a_2 = -1$ ,  $a_{n+2} = na_{n+1} - 2a_n$  for  $n \geq 1$ .    **SCORE:** \_\_\_\_\_ / 4 PTS

$$n=1: a_3 = 1a_2 - 2a_1 = \underline{1(-1) - 2(1) = -3} \textcircled{1}$$

$$n=2: a_4 = 2a_3 - 2a_2 = \underline{2(-3) - 2(-1) = -4} \textcircled{1}$$

$$n=3: a_5 = 3a_4 - 2a_3 = \underline{3(-4) - 2(-3) = -6} \textcircled{1}$$

$$n=4: a_6 = 4a_5 - 2a_4 = \underline{4(-6) - 2(-4) = -16} \textcircled{1}$$

You begin your first job, and taking the advice of your math instructor, you start saving for retirement immediately. **SCORE:** \_\_\_\_ / 4 PTS  
Your first month, you deposit \$97 into your account. Each month after that, you deposit \$8 more than you deposited the previous month.  
You leave the job the day before your 3<sup>rd</sup> anniversary. How much money did you deposit into the retirement account altogether?

$$97 + 105 + 113 + \dots$$

$\xrightarrow{+8} \quad \xrightarrow{+8}$

ARITHMETIC SERIES  
 $d = 8$

3 YEARS = 36 MONTHS

$$\begin{aligned} S_{36} &= \frac{1}{2}(36)(2(97) + (35)(8)) \\ &= 18(194 + 280) \\ &= 18(474) = \$8,532 \end{aligned}$$

Consider the geometric sequence with  $a_1 = -32$  and  $a_4 = 108$ .

SCORE: \_\_\_\_ / 6 PTS

[a] Find the formula for  $a_n$ .

$$a_n = a_1 r^{n-1}$$

$$a_4 = a_1 r^3$$

$$\textcircled{1} \quad 108 = -32r^3$$

$$r^3 = -\frac{108}{32} = -\frac{27}{8} \rightarrow r = -\frac{3}{2} \quad \textcircled{1}$$

$$a_n = -32\left(-\frac{3}{2}\right)^{n-1} \quad \textcircled{1}$$

[b] Find the sum of the first 9 terms of the sequence above.

$$S_9 = \boxed{\frac{-32(1 - (-\frac{3}{2})^9)}{1 - (-\frac{3}{2})}} = \frac{-32(1 - (-\frac{3}{2})^9)}{\frac{5}{2}} \cdot \frac{2}{2} = \frac{-64}{5} (1 - (-\frac{3}{2})^9) \quad \textcircled{2} \quad \textcircled{1}$$