Name: _____ **Show work needed to justify your answer.** Date: _____

HW: # 18a: Math IBSL - Standard 18 - Arithmetic and Geometric Sequences 5 points

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1 For the following sequences, determine whether they are geometric and if so, find the term indicated.

a 9, 27, 81, … u_6 $r=3$

$u_6 = 9 \cdot 3^{6-1}$

$u_6 = 9 \cdot 3^5 \rightarrow \boxed{u_6 = 2187}$

$\frac{6}{-4} = \frac{-3}{2}$, $\frac{-9}{6} = \frac{-3}{2}$

d $-4, 6, -9, \ldots u_8$

$u_8 = -4 \cdot \left(\frac{-3}{2}\right)^{8-1}$

$u_8 = -4\left(\frac{-3}{2}\right)^7 \rightarrow \boxed{u_8 = \frac{2187}{32}}$

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3 Write the first five terms of a geometric sequence in which the sixth term is 64.

$u_6 = 64$

one possible way:

$64 = u_1 \cdot r^{6-1}$

$64 = u_1 \cdot r^5$ let $r=2$

$64 = u_1 \cdot 2^5$

$64 = 32u_1 \rightarrow u_1 = 2$

$\boxed{2, 4, 8, 16, 32}$

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1 If a geometric sequence has $u_5 = 40$ and $u_{10} = 303.75$, find the value of u_{15}.

$40 = u_1 \cdot r^4$ And $303.75 = u_1 \cdot r^9$

$\frac{40}{r^4} = u_1$ $\frac{303.75}{r^9} = u_1$

$\frac{40}{r^4} = \frac{303.75}{r^9}$

$40r^9 = 303.75r^4$

$40r^5 = 303.75$

$r^5 = 7.59375$

$r = 1.5$

$40 = u_1 \cdot 1.5^4$

$40 = 5.0625u_1$

$u_1 = 7.901$

$u_{15} = 7.901 \cdot 1.5^{14}$

$\boxed{u_{15} = 2306.6}$

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2 For a geometric sequence that has $r = -\frac{4}{5}$ and $u_6 = -1\,280$, find the 20th term.

$u_6 = u_1 \cdot \left(-\frac{4}{5}\right)^5$

$-1280 = -0.32768u_1$

$u_1 = 3906.25$

$u_{20} = 3906.25 \cdot \left(-\frac{4}{5}\right)^{19}$

$\boxed{u_{20} = -56.3}$

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3 If 16, $x+2$, 1 are the first three terms of a geometric sequence, find all possible values of x.

$1 = 16 \cdot r^{3-1}$

$1 = 16 \cdot r^2$

$\frac{1}{16} = r^2$

$\pm\frac{1}{4} = r$

$x+2 = 16 \cdot \frac{1}{4}^{2-1}$

$x+2 = 16 \cdot \frac{1}{4}$

$x+2 = 4$

$\boxed{x=2}$

OR

$x+2 = 16\left(-\frac{1}{4}\right)^{2-1}$

$x+2 = 16\left(-\frac{1}{4}\right)$

$x+2 = -4$

$\boxed{x=-6}$

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4 Find the number of terms in the geometric sequence

6, 12, 24, ..., 1536

$r=2$

$1536 = 6 \cdot 2^{n-1}$

$256 = 2^{n-1}$

$\ln 256 = \ln 2^{n-1}$

$\ln 256 = (n-1)\ln 2$

$n-1 = \frac{\ln 256}{\ln 2}$

$n-1 = 8$

$\boxed{n=9}$

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7 An old legend states that a peasant won a reward from a king. The peasant asked to be paid in rice; one grain on the first square of a chessboard, two grains on the second, four on the third square, and so on.

$u_1=1 \quad u_2=2 \quad u_3=4$

$1, 2, 4 \quad r=2$

a How many grains of rice would be on the 30th square?

$u_{30} = 1 \cdot 2^{30-1}$

$u_{30} = 2^{29}$

$\boxed{u_{30} = 538670912}$

b Which square would contain exactly 512 grains of rice?

(b)

$512 = 1 \cdot 2^{n-1}$

$\ln 512 = (n-1)\ln 2$

$n-1 = \frac{\ln 512}{\ln 2} \rightarrow n-1 = 9 \rightarrow \boxed{n=10}$