Warm Up: Olivia graphs the function $g(x)=5x^2+30$ and observes that $g(x)$ has no x-intercepts. She uses the information to conclude that there are no solutions to $5x^2+30=0$. To verify her conclusion, Olivia solves the equation $5x^2+30=0$ algebraically, and gets two solutions. Which statement is true about this situation?

imaginary

(1) Original conclusion was correct. She made a mistake solving algebraically.

(2) Original conclusion false. Equation has complex solutions $\pm 6i$.

(3) Original conclusion false b/c she graphed incorrectly. X-intercepts are $\pm\sqrt{6}$

(4) Original conclusion false. Complex solutions at $\pm i\sqrt{6}$

WARM UP

$5x^2+30=0$

$5(x^2+6)=0$

$5 \neq 0 \qquad x^2+6=0$

$\sqrt{x^2}=\pm\sqrt{-6}$

Arithmetic Sequences

example: 1, 3, 5, 7, ... $+2$

$a_1 = 1$

$a_n = a_{n-1} + 2$

Common difference the # being added/subtracted in an arithmetic sequence

Arithmetic sequence Sequence where terms are found by adding/subtracting the same #

*constant Rate of change (slope)

→ LINEAR

Formula (explicit): $a_n = a_1 + (n-1)d$

* will find any term*

a_n = n^{th} term

a_1 = 1^{st} term

n = term #

d = common difference (slope)

Examples:

-3

1) For the arithmetic sequence 100, 97, 94, 91, … find the:
a. common difference b. 20th term

1 2 3 4

$d = -3$

$a_n = a_1 + (n-1)(d)$

$a_{20} = 100 + (20-1)(-3)$

$\boxed{a_{20} = 43}$

2) Scott is saving to buy a guitar. In the first week, he put aside \$42 that he received for his birthday, and in each of the following weeks, he added \$8 to his savings. He needs \$400 total for the guitar that he wants. In which week will he have enough money for the guitar?

$a_1 = 42$

$d = 8$

$a_n = a_1 + (n-1)d$

$400 = 42 + (n-1)(8)$

$\frac{358}{8} = \frac{(n-1)8}{8}$

$45.75 = n$

after 46 weeks

3) The 4th term of an arithmetic sequence is 80 and the 12th term is 42.
a. What is the common difference? b. What is the 1st term of the sequence?

$a_4 = 80$

$a_{12} = 42$

x	y
4	80
12	42

a) $d = ?$ -4.75

$\frac{42-80}{12-4} = -\frac{19}{4}$

94.25	89.5	84.75	80
1	2	3	4

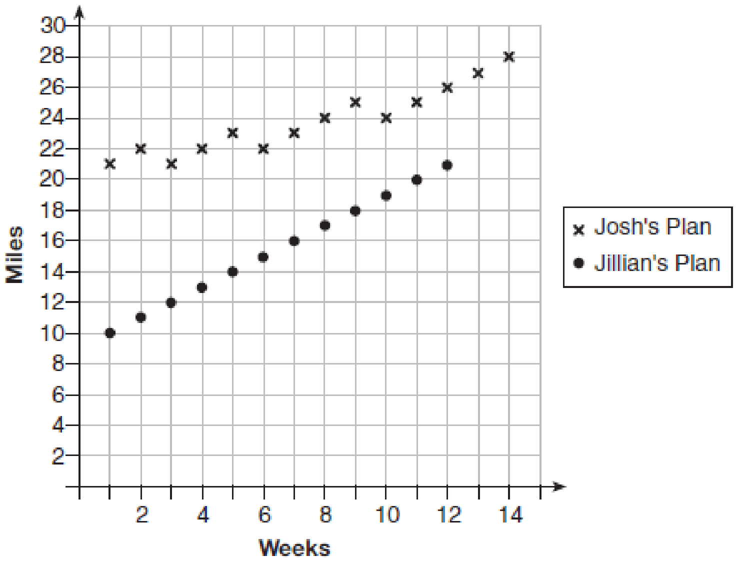
$a_n = a_1 + (n-1)d$

$42 = a_1 + (12-1)(4.75)$

or

$80 = a_1 + (4-1)(4.75)$

Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian's 12-week plan and Josh's 14-week plan. The number of miles run per week for each plan is plotted below.



Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer.

Jillian's. It's linear.

Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose.

$a_1 = 10$ $a_n = a_{n-1} + 1$

Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.

$a_n = 10 + (n-1)(1)$

Geometric Sequences

geometric sequence- Sequence by multiplying the same # every time

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

*exponential

common ratio- (r) # being multiplied to each term in a geometric sequence

a_1 r

Which of the following is equivalent to the geometric sequence modeled by the equation $\boxed{a_n=3(4)^{n-1}}$? explicit

(1) $a_1=3$, $a_{n+1}=4a_n$

(2) $a_1=4$, $a_{n+1}=3a_n$

(3) $a_1=12$, $a_{n+1}=4a_n$

(4) $a_1=3$, $a_{n+1}=(a_n)^3$

Examples:

1) What is the formula for the n th term of the sequence $\boxed{54, 18, 6, ...?}$ $\div 3$

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

$a_n = 54\left(\frac{1}{3}\right)^{n-1}$

2) What is the common ratio of a geometric sequence whose first term is 27 and whose 4th term is 64?

3) What is the common ratio in the following geometric sequence? $6, -3, \frac{3}{2}, -\frac{3}{4}, ...$

$a_n = 6\left(-\frac{1}{2}\right)^{n-1}$

$\boxed{r = -\frac{1}{2}}$

$n = 15$

4) What is the fifteenth term of the geometric sequence $-\sqrt{5}, \sqrt{10}, -2\sqrt{5}, ...?$

1 2 3

$-\sqrt{5} \cdot \sqrt{2} = \sqrt{10}$

$\sqrt{10} \cdot \sqrt{2} = -\sqrt{20}$

$\sqrt{4 \cdot 5}$

$-2\sqrt{5}$

$r = -\sqrt{2}$

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

$a_{15} = -\sqrt{5}(-\sqrt{2})^{15-1}$

$a_{15} = -\sqrt{5}(+128)$

$-128\sqrt{5}$

$-\sqrt{5}(-\sqrt{2})^{14}$

-286.2167011

$(-\sqrt{2})^{14}$

+128

The recursive formula to describe a sequence is shown below.

$$a_1 = 3$$

$$a_n = 1 + 2a_{n-1}$$

State the first four terms of this sequence. Can this sequence be represented using an explicit geometric formula? Justify your answer.

The eighth and tenth terms of a sequence are 64 and 100. If the sequence is either arithmetic or geometric, the ninth term can *not* be

1) -82
2) -80
3) 80
4) 82