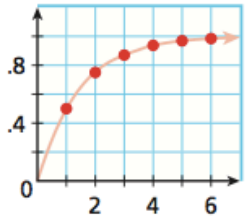
Infinite Geometric Series
12.5

An ***Infinite Geometric Series*** is a geometric series that has infinite terms

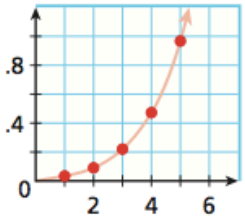
$S_n = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \cdots$

Partial Sums						
n	1	2	3	4	5	6
S_n	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{15}{16}$	$\frac{31}{32}$	$\frac{63}{64}$



$R_n = \frac{1}{32} + \frac{1}{16} + \frac{1}{8} + \frac{1}{4} + \frac{1}{2} + \cdots$

Partial Sums						
n	1	2	3	4	5	6
R_n	$\frac{1}{32}$	$\frac{3}{32}$	$\frac{7}{32}$	$\frac{15}{32}$	$\frac{31}{32}$	$\frac{63}{32}$



What is the common ratio for the first series?

$$r = \frac{a_2}{a_1}$$

What is the common ratio for the second series?

Looking at the two graphs, which would you consider to be "converging" and which would be "diverging"?

A geometric series is considered to be ***Diverging*** if $|r| \geq 1$.

A geometric series is considered to be ***Converging*** if $|r|<1$.

I Try:
Determine if the geometric series converges or diverges.
20 + 24 + 28.8 + 34.56+…

Find the common ratio $r = \frac{a_2}{a_1}$	$\frac{24}{20} = \frac{6}{5}$
Diverging if $\|r\| \geq 1$. Converging if $\|r\|<1$.	$\frac{6}{5} > 1$ Diverging

We Try:
Determine if the geometric series converges or diverges.
$1 - 2 + 4 - 8 + 16$+…

Find the common ratio $r = \frac{a_2}{a_1}$	
Diverging if $\|r\| \geq 1$. Converging if $\|r\|<1$.	

You Try with your partner.
Even Talk, Odd Write

1) Determine if the geometric series converges or diverges.

$$\frac{2}{3} + 1 + \frac{3}{2} + \frac{9}{4} + \frac{27}{8} + \cdots$$

Find the common ratio $r = \frac{a_2}{a_1}$	
Diverging if $\|r\| \geq 1$. Converging if $\|r\| < 1$.	

2) Determine if the geometric series converges or diverges.

Even Write, Odd Talk
32 + 16 + 8 + 4 + 2 + …

Find the common ratio $r = \frac{a_2}{a_1}$	
Diverging if $\|r\| \geq 1$. Converging if $\|r\| < 1$.	

If an infinite geometric series converges, we can find the sum of it!

Sum of an Infinite Geometric Series

The sum of an infinite geometric series S with common ratio r and $|r| < 1$ is

$$S = \frac{a_1}{1 - r},$$

where a_1 is the first term.

I Try:

Find the sum of the geometric series if it exists.

5 + 4 + 3.2 + 2.56 +…

Find the common ratio	$r = \frac{a_2}{a_1} = \frac{4}{5}$
Does it converge?	$\frac{4}{5} < 1$ Converges
Plug $a_1 and$ "r" into $S = \frac{a_1}{1 - r}$	$S = \frac{5}{(1 - \frac{4}{5})}$
Simplify	$S = (\frac{5}{\frac{1}{5}}) = 25$

We Try:

Find the sum of the geometric series if it exists.

$$\sum_{k=1}^{\infty} \frac{2}{3^{k-1}}$$

Find the common ratio	
Does it converge?	
Plug $a_1 and$ "r" into $S = \frac{a_1}{1-r}$	
Simplify	

You Try:

$$\sum_{k=1}^{\infty} 60\left(\frac{1}{10}\right)^{k}$$

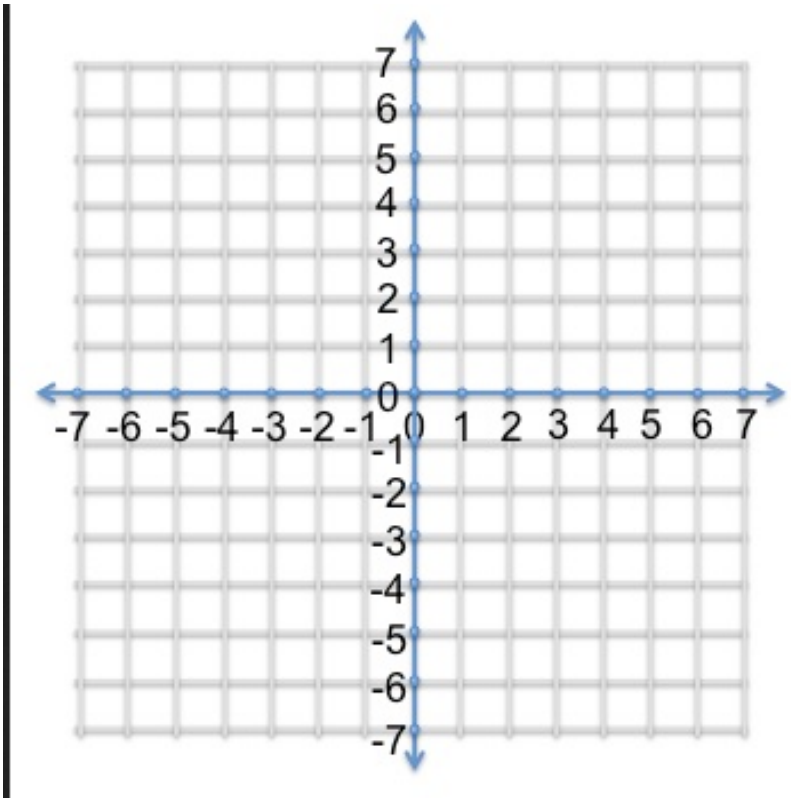
Find the common ratio	
Does it converge?	
Plug $a_1 and$ "r" into $S = \frac{a_1}{1-r}$	
Simplify	

Limits and piecewise
Section 15.1
L32
5.5.16

Factor
$1)(x^2 + 4x - 10)$
$2)(2x^2 + 5x + 2)$
$3)(x^2 - 2x - 8)$

A ***limit*** is the value that a sequence or series reaches.

Find the limits at the giving points.

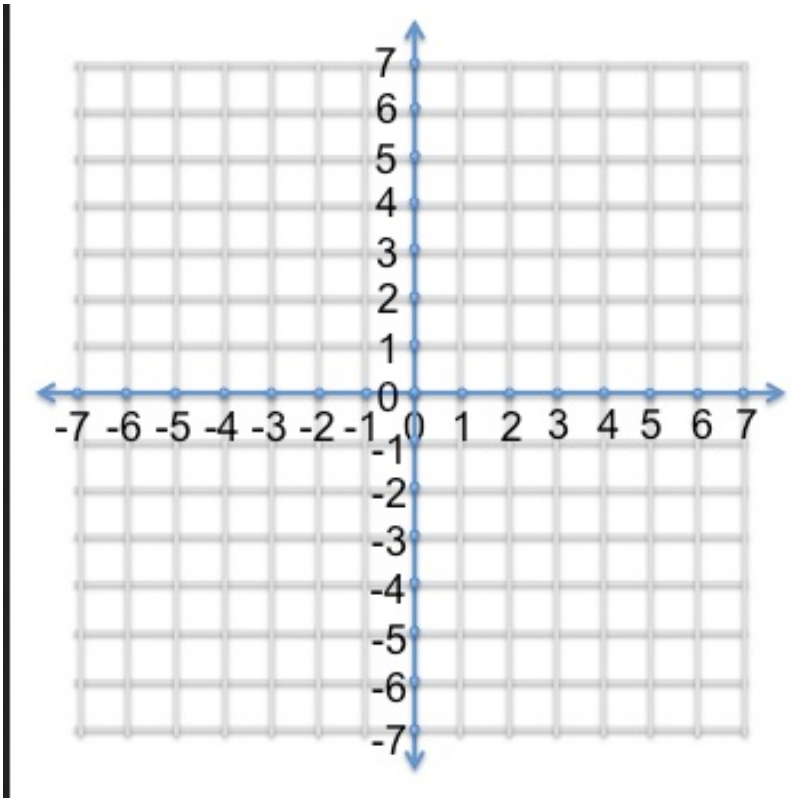


. $\lim_{x \to -2} f(x)$ and $f(-2)$

. $\lim_{x \to 0} f(x)$ and $f(0)$

. $\lim_{x \to 3} f(x)$ and $f(3)$

We Try:



What is the $\lim_{x\to\infty} \frac{1}{x}$?

What is the $\lim_{x\to\infty} \frac{2x}{3x}$

I Try:

SIMPLIFY THEN PLUG IN!

$$\lim_{x \to 4} \frac{x^2 - 2x - 8}{x^2 - 4x}$$

Factor	$\frac{x^2 - 2x - 8}{x^2 - 4x}$ $\frac{((x+2)(x-4))}{x(x-4)}$
Simplify by canceling out.	$\frac{x+2}{x}$
Plug in value for x	$\frac{6}{4} = \frac{3}{2}$

I Try:

$$\lim_{x \to 0} (1 + x + 2^x - \cos x)$$

Plug in 0 for x	$(1 + 0 + 2^0 - cos0)$
Simplify	1

We Try:

$$\lim_{h\to 0} \frac{h^3 - 4h^2 - 6h}{h}$$

Simplify	
Plug in!	

We Try:

$$\lim_{x\to 1} \frac{\frac{1}{x} - 1}{x - 1}$$

Simplify	
Plug in!	