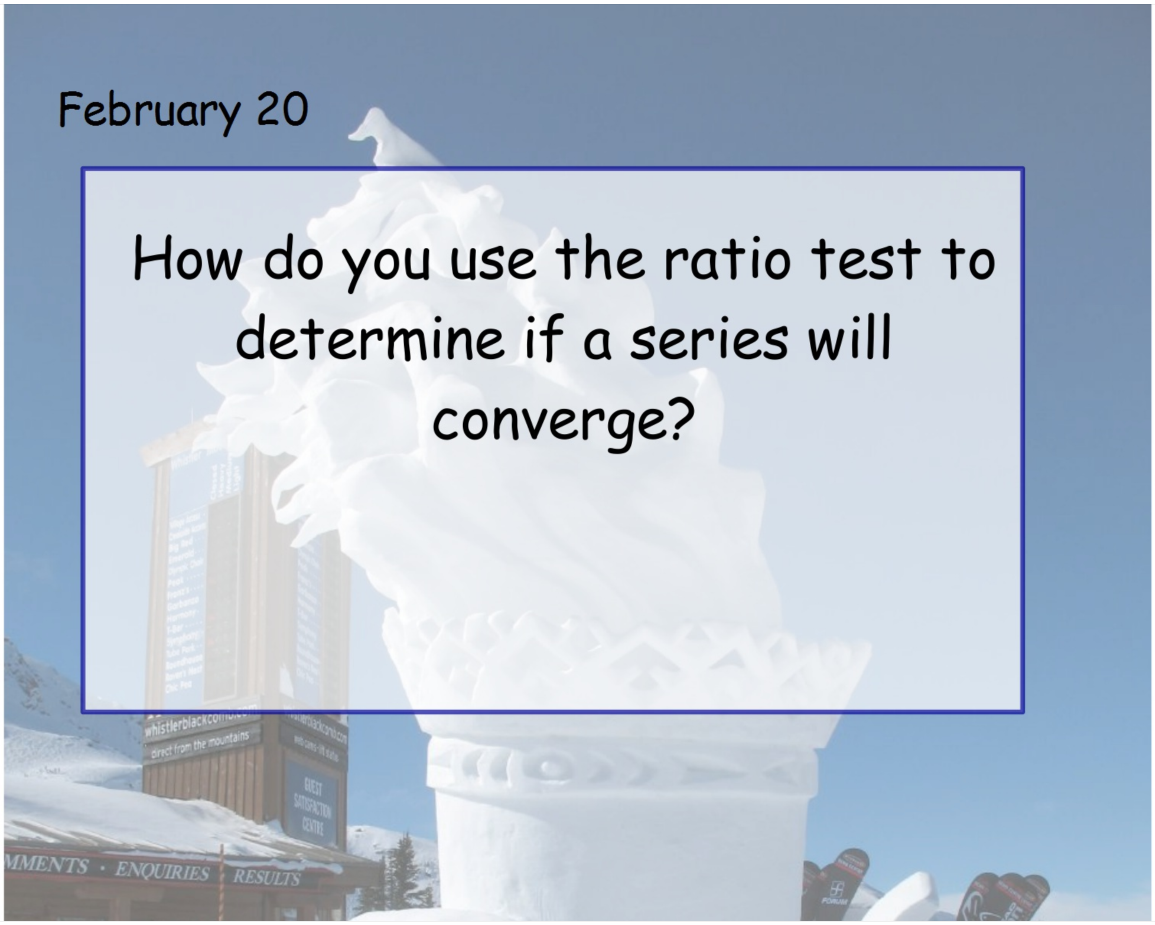
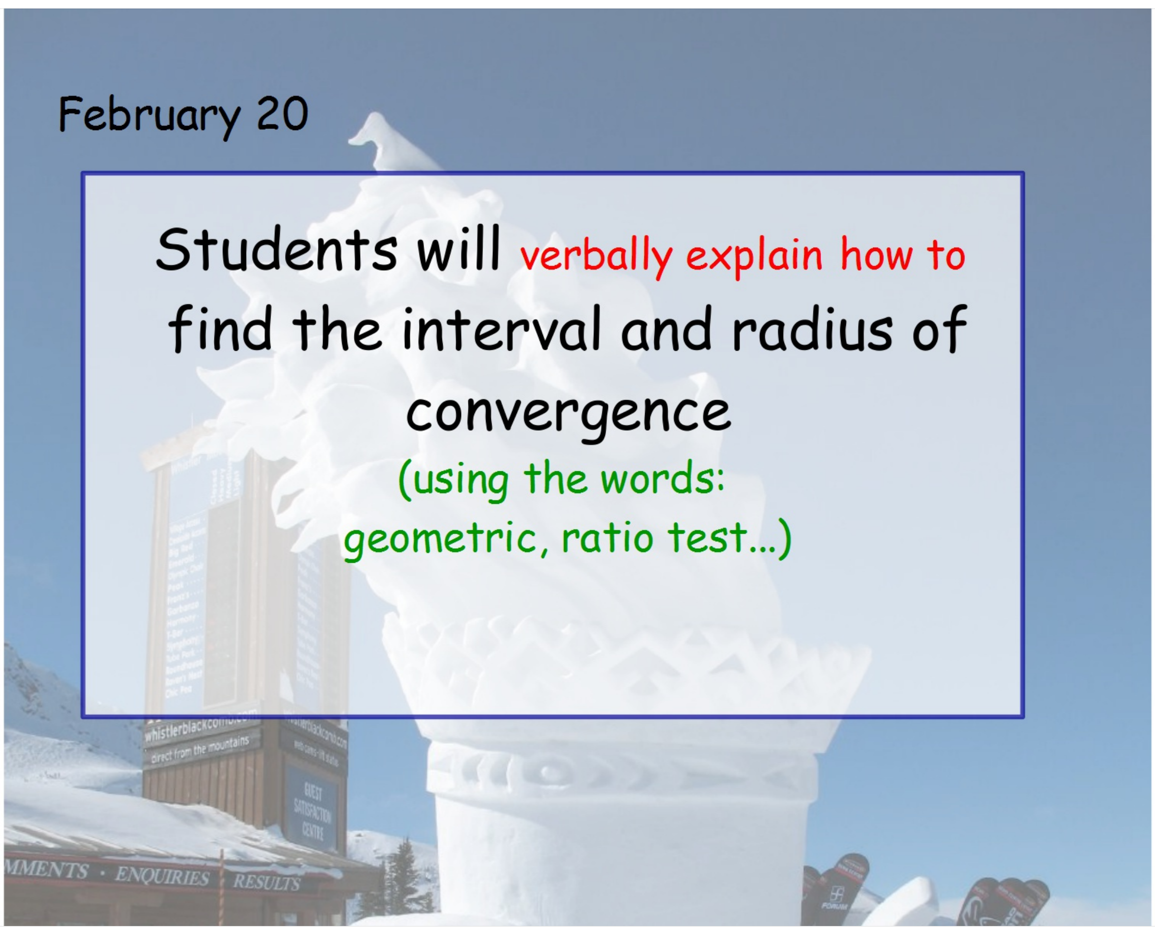

February 20
How do you use the ratio test to determine if a series will converge?


February 20
Students will verbally explain how to find the interval and radius of convergence
(using the words:
geometric, ratio test...)

Use the Ratio test to find the radius of convergence

$$\sum_{n=1}^{\infty}(-1)^{n+1}\frac{x^{2n}}{2n}$$

$a_n = (-1)^{n+1}\ \frac{x^{2n}}{2n}$ $\quad a_{n+1} = (-1)^{n+2}\ \frac{x^{2(n+1)}}{2(n+1)}$

$$\lim_{n\to\infty}\left|\frac{\frac{x^{2n+2}}{2n+2}}{\frac{x^{2n}}{2n}}\right| = \lim_{n\to\infty}\left|\frac{x^{2n+2}}{2n+2}\cdot\frac{2n}{x^{2n}}\right|$$

$$= \lim_{n\to\infty}\left|\frac{x^{2n}x^2}{x^{2n}}\cdot\frac{2n}{2n+2}\right| = \lim_{n\to\infty}\left|x^2\cdot\frac{2n}{2n+2}\right| = |x^2(1)| = x^2$$

Converge when $x^2 < 1$

$-1 < x < 1$

Radius of Convergence

$\frac{1-(-1)}{2} = 1$

What is the interval of convergence?

Check endpoints

$x=-1$

$$\sum_{n=1}^{\infty}(-1)^{n+1}\frac{(-1)^{2n}}{2n}$$

$$\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{2n} = \frac{1}{2}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n}$$

$x=1$

$$\sum_{n=1}^{\infty}(-1)^{n+1}\frac{(1)^{2n}}{2n}$$

$$\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{2n}$$

IoC

$-1 \le x \le 1$

Alternating Harmonic Series $\rightarrow$ converges at $x=-1$ and 1

Use the Ratio test to find the radius of convergence

$$\sum_{n=1}^{\infty}\frac{(x-2)^n}{3n}$$

$$\lim_{n\to\infty}\left|\frac{(x-2)^{n+1}}{3(n+1)}\cdot\frac{3n}{(x-2)^n}\right|$$

$$= \lim_{n\to\infty}\left|(x-2)\cdot\frac{3n}{3n+3}\right| = |x-2|$$

Converges when $|x-2| < 1$

$-1 < x-2 < 1$

$1 < x < 3$

Radius of Convergence

$\frac{3-1}{2} = 1$

What is the interval of convergence?

Check Endpoints

$x=1$

$$\sum_{n=1}^{\infty}\frac{(1-2)^n}{3n}$$

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

Alt. Harm. $\rightarrow$ converge at $x=1$

$x=3$

$$\sum_{n=1}^{\infty}\frac{(3-2)^n}{3n}$$

$$\sum_{n=1}^{\infty}\frac{1}{3n}$$

Harmonic Series $\rightarrow$ Diverge at $x=3$

IoC

$1 \le x < 3$