

Instructions: Work the problems below as directed. Show all work. Clearly mark your final answers. Use exact values unless the problem specifically directs you to round. Simplify as much as possible. Partial credit is possible, but solutions without work will not receive full credit.

$$1. \text{ Simplify } \frac{(2n-1)!}{(2n+1)!} = \frac{\cancel{(2n-1)} \cancel{(2n-2)} \cancel{(2n-3)} \dots \cancel{(2)} \cancel{(1)}}{(2n+1)(2n)\cancel{(2n-1)}\cancel{(2n-2)} \dots \cancel{(2)} \cancel{(1)}} = \frac{1}{(2n+1)(2n)}$$

2. Write the first five terms of the sequence.

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

$$a_1 = (-1)^2 \left(\frac{2}{1}\right) = 2$$

$$a_2 = (-1)^3 \left(\frac{2}{2}\right) = -1$$

$$a_3 = (-1)^4 \left(\frac{2}{3}\right) = \frac{2}{3}$$

$$a_4 = (-1)^5 \left(\frac{2}{4}\right) = -\frac{1}{2}$$

$$a_5 = (-1)^6 \left(\frac{2}{5}\right) = \frac{2}{5}$$

b. $a_1 = 6, a_{k+1} = \frac{1}{3}a_k^2$

$$a_1 = 6$$

$$a_2 = \frac{1}{3}(36) = 12$$

$$a_3 = \frac{1}{3}(144) = 48$$

$$a_4 = \frac{1}{3}(2304) = 768$$

$$a_5 = \frac{1}{3}(589,824) = 196,608$$

3. Determine if the sequence converges. Is it bounded? Is it monotonic?

a. $a_n = \frac{n}{2^{n+2}}$ bounded, it is not strictly monotonic, but it converges is after $n \geq 2$

b. $a_n = \frac{\sin(\sqrt{n})}{n}$ converges bounded it is not monotonic