

Sequences: n^{th} term and limiting values

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Worked example

Find the n^{th} term of the sequence:

$$\frac{1}{5}, \frac{8}{9}, \frac{27}{13}, \frac{64}{17}, \dots$$

Your turn

Find the n^{th} term of the sequence:

$$\frac{1}{3}, \frac{4}{7}, \frac{9}{11}, \frac{16}{15}, \dots$$

$$\frac{n^2}{4n - 1}$$

Worked example

Sequence A has n^{th} term $\frac{n}{41n-20}$

Sequence B has n^{th} term $\frac{1}{2n}$

The k^{th} term of sequence A equals the k^{th} term of sequence B.

Find k

Your turn

Sequence A has n^{th} term $\frac{n}{14n+30}$

Sequence B has n^{th} term $\frac{2}{n}$

The k^{th} term of sequence A equals the k^{th} term of sequence B.

Find k

$$k = 30$$

Worked example

a) Find the n^{th} term of the sequence:

$$9, \frac{13}{6}, \frac{17}{11}, \frac{21}{16}, \dots$$

b) Hence find the limit of the sequence as $n \rightarrow \infty$

Your turn

a) Find the n^{th} term of the sequence:

$$\frac{1}{5}, \frac{4}{7}, \frac{7}{9}, \frac{10}{11}, \dots$$

b) Hence find the limit of the sequence as $n \rightarrow \infty$

a) $\frac{3n-2}{2n+3}$

b) $\frac{3}{2}$

Worked example

Show that the limiting value of $\frac{2n^2+7}{3n^2-2}$ as $n \rightarrow \infty$ is $\frac{2}{3}$

Your turn

Show that the limiting value of $\frac{2n^2+7}{3n^2-2}$ as $n \rightarrow \infty$ is $\frac{2}{3}$

Shown

$$= \frac{2 + \frac{7}{n^2}}{3 - \frac{2}{n^2}}$$

As $n \rightarrow \infty$, $\frac{7}{n^2} \rightarrow 0$ and $\frac{2}{n^2} \rightarrow 0$

$$\therefore \frac{2 + \frac{7}{n^2}}{3 - \frac{2}{n^2}} \rightarrow \frac{2}{3}$$

Worked example

Find the limit of the sequence as $n \rightarrow \infty$
where the n^{th} term of the sequence is:

$$\frac{9n^2 - 5}{18n^2 + 1}$$

Your turn

Find the limit of the sequence as $n \rightarrow \infty$
where the n^{th} term of the sequence is:

$$\frac{6n^2 + 1}{18n^2 - 5}$$

$$\frac{1}{3}$$

Worked example

The n^{th} term of a sequence is

$$T_n = \frac{23n}{7n - 3}$$

- i) Work out the largest value of n for which $T_n > 4$
- ii) Write down the limiting value of T_n as $n \rightarrow \infty$

Your turn

The n^{th} term of a sequence is

$$T_n = \frac{32n}{3n - 7}$$

- i) Work out the largest value of n for which $T_n > 11$
- ii) Write down the limiting value of T_n as $n \rightarrow \infty$

i) 76

ii) $\frac{32}{3}$

Worked example

The n^{th} term of a sequence is $\frac{5n}{3n+7}$

a) Work out the position of the term that has a value of $\frac{1}{2}$

b) Write down the limiting value of $\frac{3n}{5n+12}$ as $n \rightarrow \infty$

Your turn

The n^{th} term of a sequence is $\frac{3n}{5n+12}$

a) Work out the position of the term that has a value of $\frac{1}{2}$

b) Write down the limiting value of $\frac{3n}{5n+12}$ as $n \rightarrow \infty$

a) 12

b) $\frac{3}{5}$

Worked example

The n^{th} term of a sequence is $\frac{14-7n}{14+7n}$

- a) Work out the position of the term that has a value of 0
- b) Write down the limiting value of $\frac{14-7n}{14+7n}$ as $n \rightarrow \infty$

Your turn

The n^{th} term of a sequence is $\frac{1420-5n}{1420+5n}$

- a) Work out the position of the term that has a value of 0
- b) Write down the limiting value of $\frac{14-7n}{14+7n}$ as $n \rightarrow \infty$

a) 284

b) -1