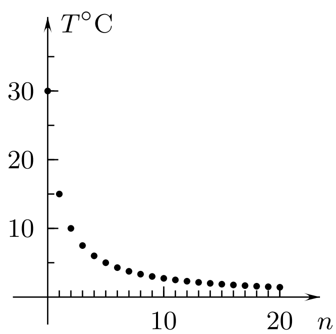
Math 10B. Lecture Examples.

Section 9.1. Sequences[†]

Example 1 A piece of meat at 30°C is put in a freezer at time $n = 0$. The temperature of the freezer is 0°C, and the temperature of the meat n hours later is $T = \dfrac{30}{n+1}$ (Figure 1). Does the sequence $\left\{\dfrac{30}{n+1}\right\}_0^\infty$ as $n \to \infty$ converge? If so, what is its limit?

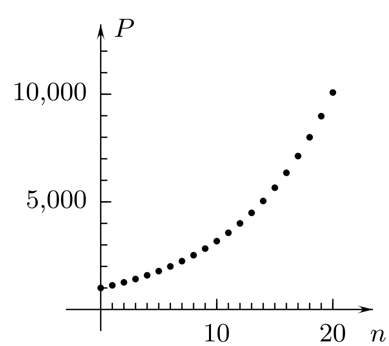
FIGURE 1



Answer: $\displaystyle\lim_{n\to\infty} \frac{30}{n+1} = 0$ converges and its limit is 0. (The temperature of the meat approaches the temperature of the freezer as $n \to \infty$.)

Example 2 Figure 2 shows the graph of the population $P = 1000(2^{n/6})$ on day n of a colony of bacteria that consists of 1000 bacteria at $n = 0$ **(a)** How long does it take for the population to double? **(b)** Does the sequence $\left\{1000(2^{n/6})\right\}_{n=0}^\infty$ converge?

FIGURE 2



Answer: **(a)** The population doubles every 6 days. **(b)** • $\left\{1000(2^{n/6})\right\}_{n=0}^\infty$ diverges.

[†]Lecture notes to accompany Section 9.1 of *Calculus* by Hughes-Hallett et al.

Example 3 Figure 3 shows the graph of the the number of days $y = d_n$ in February of year $n \geq 2000$: d_n is 29 for leap years n when $n/4$ is an integer and is 28 other years. What happens to the sequence $\{d_n\}_{n=2000}^{\infty}$ as $n \to \infty$?

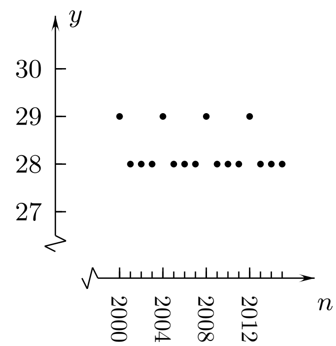


FIGURE 3

Answer: $\{d_n\}_{n=2000}^{\infty}$ diverges.

Example 4 Does the sequence $\left\{e^{1/\sqrt{n}}\right\}_{n=1}^{\infty}$ converge or diverge? If it converges, give its limit.

Answer: The sequence converges and its limit is 1. (The table below shows that the limit is approached relatively slowly.)

n	1	10	100	1000	10,000	100,000
$e^{1/\sqrt{n}} \doteq$	2.7183	1.3719	1.1052	1.0321	1.0101	1.0010

Interactive Examples

Work the following Interactive Examples on Shenk's web page, http//www.math.ucsd.edu/˜ashenk/:[‡]

Section 10.1: Examples 1–5

[‡]The chapter and section numbers on Shenk's web site refer to his calculus manuscript and not to the chapters and sections of the textbook for the course.