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ACT 1.12 *Application of limits*
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1. Calculating a Child's Dosage

Since most pharmaceutical reference manuals only list adult dosages, pediatricians have to be especially careful when calculating dosages for their patients. Fortunately, there are several methods to choose from when calculating how much of a particular antibiotic or medication should be prescribed to a child. In this activity, we focus on one calculation method Young's Rule.

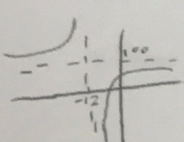
If we let d = the child's dosage (in mg), D = the adult dosage (in mg), and A = the child's age (in years), then we have the following:

Young's Rule: $d = \frac{DA}{A+12}$

a) Suppose the adult dosage of an antibiotic is 100mg per day. Use the Young's Rule to determine the corresponding children's dosage for the given ages.

$d = \frac{100(A)}{A+12}$

Child's Age	Young's Rule
2	14.3
4	25
6	$33.\bar{3}$
8	40
10	$45.\overline{45}$
12	50



b) Use Geogebra to graph the function $d = \frac{DA}{A+12}$ $= \quad d = \frac{100(A)}{A+12} \quad \left[y = \frac{100x}{x+12}\right]$ HA $= \frac{100}{1} = 100$

VA = $x = -12$

c) The value of A could be negtive? Explain

no, we're talking abaut ages

d) If a 2 year-old child takes 12.5 mg ¿What is the adult dosage? $12.5 = \frac{D(2)}{2+12} \quad \frac{14(12.5)}{2} = \boxed{87.5mg}$

e) Find the $\lim_{A \to +\infty} d(D)$ and explain the meaning of this value in the context

$\lim_{A \to +\infty} d(D) = 100$

2. Environment. A utility company burns coal to generate electricity. The cost C in dollars of removing p% of the air pollutants in the stack emissions is

$\lim_{x \to 5^-} f(x)$ ... 10) $\lim_{x \to 5^+} [f(x)]$ $-\infty$ 11) $\lim_{x \to 5} [f(x)]$ ∄ $f(5) =$ ∄

$$C=\frac{80,000p}{100-p} \qquad 0\leq p<100$$

Find the cost of removing

a) 15% 14117.65

b) 50% 80000

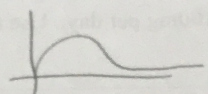
c) 90% of the pollutants 720000

d) Find the limit of C as $p\to 100^-$ $\lim_{p\to 100^-} C = +\infty$

Larson, R. and Edwards, B., 2010, Calculus of a single variable, Washington, D.C., United States of America, CENGAGE Learning.

3. A drug given to a patient and the concentration of the drug in the boodstream is carefully monitored. At time $t\geq 0$ (in minutes after patient receiving the drug), the concentration in milligrams per litre (mg/l) is given by the following function

$$C(t)=\frac{25t}{t^2+4}$$



a) Sketch the graph of the drug concentration (mg/l) versus time (min).

b) tavle When the highest concentration of the drug occurs, and what is it? 2 / 6.25

c) What eventually happens to the concentration of the drug in the blood steam?

d) Write a mathematical expression that shows the behavior of the concentration as time goes by rules

$\lim_{t\to\infty} f(t)=0$

4. The game commission introduces 100 deer into newly acquired state game lands. The population N of the herd is modeled by

$$N=\frac{100+60t}{1+0.04t} \qquad t\geq 0$$

a) Find the population when t = 5, t = 10 and t = 25 333.33 500 800

b) What is the limiting size of the herd as time increases? rules

$\lim_{x\to\infty} N(t)=1500$

5. Psychologist have developed mathematical models to predict memory performance as a function of the number of trials n of a certain task. Consider the learning curve

$$P=\frac{0.5+0.9(n-1)}{1+0.9(n-1)} \qquad n>0$$

where P is the fraction of correct responses after n trials.

a) Complete the table for this model. What does it suggest?

n	1	2	3	4	5	6	7	8	9	10
P	0.5	0.737	0.821	0.865	0.891	0.909	0.922	0.932	0.939	0.945

b) According to this model, what is the limiting percer of correct responses as n increases? rules

$\lim_{n\to\infty} P(n)=1$

9) $\lim_{x\to 5^-}[f(x)]$ 4

8) $\lim_{x\to -7}[f(x)]$ −4

10) $\lim_{x\to 5^+}[f(x)]$ $-\infty$

11) $\lim_{x\to 5}[f(x)]$ ∄