Homework 1/28

1. A population of critters is measured by the function

\[ P(t) = 100(2^{t/5}) \]

where \( t \) is measured in years and \( P \) is measured in critters.

(a) Graph \( P(t) \) on the domain \( 0 \leq t \leq 15 \) years. Be sure to label your graph correctly.

(b) Find the rate of change of \( P \) on the interval \( 3 \leq t \leq 5 \) years. Correct units are required.

(c) Repeat for the intervals:
   i. \([4, 5]\)
   ii. \([5, 6]\)
   iii. \([5, 7]\)

(d) In your graph from part (a), sketch secant lines whose slopes match these four rates of change.

(e) Compute the rate of change of \( P \) on the interval \([5, a]\).

2. The position of a moving object is measured by the function

\[ s(t) = 2 \sin(\pi(t - 0.5)) \]

where \( t \) is measured in minutes and \( s \) is measured in feet.

(a) Graph \( s(t) \) on the domain \( 0 \leq t \leq 4 \) minutes. Be sure to label your graph correctly.

(b) Find the rate of change of \( s \) (with units) on each of the intervals:
   i. \([0, 1]\)
   ii. \([0.5, 1]\)
   iii. \([1, 1.5]\)
   iv. \([1, 2]\)
   v. \([1, a]\)

(c) Sketch secant lines for the first four rates.

3. The voltage in a circuit is given by

\[ V(t) = |t| \]

where \( t \) is measured in seconds and \( V \) is measured in Volts.

(a) Graph \( V(t) \) on the domain \(-3 \leq t \leq 3\) seconds. Be sure to label your graph correctly.
(b) Find the rate of change of $V$ (with units) on each of the intervals:

i. $[-2, 0]$
ii. $[-1, 0]$
iii. $[0, 1]$
iv. $[0, 2]$
v. $[0, a]$

(c) Sketch secant lines for the first four rates.

4. Graph the function $f(x) = x^{2/3}$. (Your calculator might lie to you about this. Plot some points by hand if you need to.)

(a) Find the rate of change of $f$ on each of the intervals:

i. $[-2, 0]$
ii. $[-1, 0]$
iii. $[0, 1]$
iv. $[0, 2]$
v. $[0, a]$

(b) Sketch secant lines for the first four rates.

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**Hints and Answers**

1. d) $100(2^{a/5} - 2)/(a - 5)$; b) plug in 3 for $a$; c) plug in 4, 5 or 6.

2. b)(v) $(2 \sin \pi(a - 0.5) - 2)/(a - 2)$; plug in numbers for (i)-(iv).

3. b)(i) $-1$ V/s, (ii) $-1$ V/s, (iii) 1 V/s, (iv) 1 V/s, (v) depends on whether $a$ is positive or negative. Work the problem twice.

4. b)(i) $-.793$, (ii) $-1$, (iii) 1, (iv) .793. (v) depends on whether $a$ is positive or negative. Work the problem twice.