

Total 30

## Homework 1

Sections 2.1 - 2.4  
Due: Monday, September 29

See syllabus for all homework directions (points will be taken off if not followed). All work must be shown, no work means no credit!

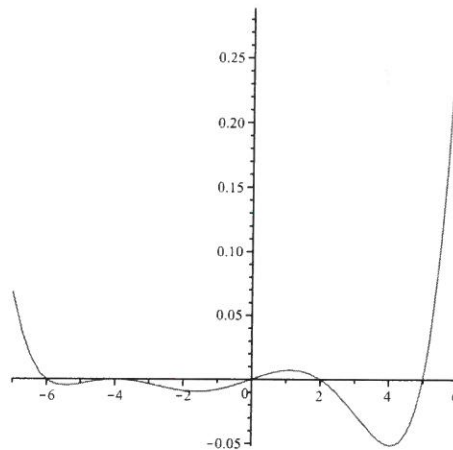
- 5 1. The following table gives the position of a particle moving along the  $x$ -axis as a function of time,  $t$ , in seconds, where  $x$  is in centimeters. What is the average velocity of the particle from  $t = 2$  to  $t = 6$ ?

$t$	0	2	4	6	8
$x(t)$	0	14	-6	-18	-4

- 6 2. A particle moves at varying velocity along a line and  $s = f(t)$  represents the particle's distance from a point as a function of time,  $t$ . Sketch a possible graph for  $f$  if the average velocity of the particle between  $t = 2$  and  $t = 6$  is the same as the instantaneous velocity at  $t = 5$ .

- 7 3. Use the definition of the derivative to find  $f'(x)$  where  $f(x) = \frac{1}{x+2}$ .

- 8 4. If the following function shows  $f(x)$ , draw  $f'(x)$ .



- 10 5. If  $t$  is the number of years since 2011, the population,  $P$ , of China, in billions, can be approximated by the function

$$P = f(t) = 1.34(1.004)^t.$$

- 11 (a) Evaluate  $f(9)$ . Explain what this means in the context of the problem.  
(b) Use at least 3 values of  $h$  and approximate  $f'(9)$ . (Note, we have not covered how to find  $f'(t)$  directly yet, but we can approximate.) Explain what this means in the context of the problem.  
(c) Using (a) and (b) what do these values tell us about the population of China?

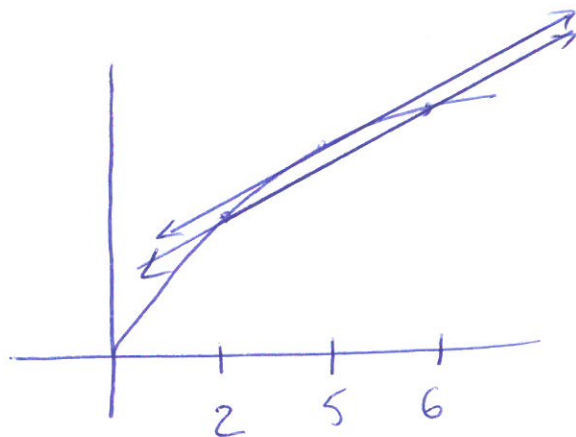
- 12 6. The distance in feet of a particle from a fixed position at time  $t$  seconds is given by  $s(t)$ . If  $s(5) = 10$  and  $v(5) = -2$  write the equation of the tangent line to  $s(t)$  at  $t = 5$ .

# think 1 (Key)

$$1) \frac{-18 - 14}{6 - 2} = -8$$

+5

2) Varies



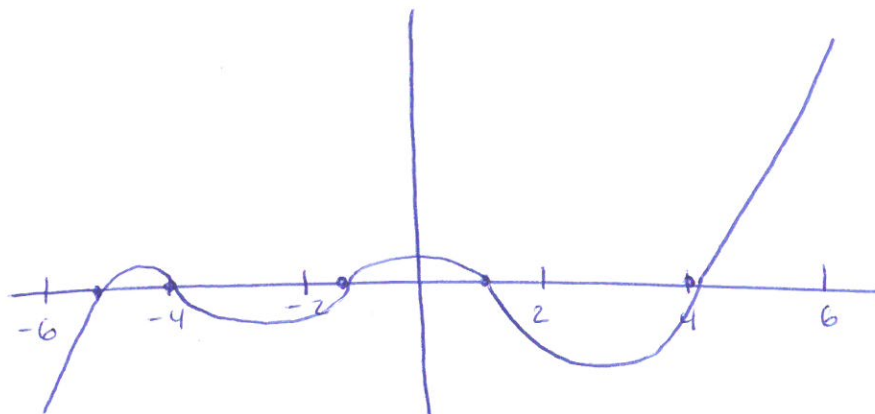
+5

$$\begin{aligned} 3) f'(x) &= \lim_{h \rightarrow 0} \frac{\frac{1}{x+h+2} - \frac{1}{x+2}}{h} \\ &= \lim_{h \rightarrow 0} \frac{\frac{x+2}{(x+h+2)(x+2)} - \frac{x+h+2}{(x+h+2)(x+2)}}{h} \\ &= \lim_{h \rightarrow 0} \frac{-h}{(x+h+2)(x+2)} \cdot \frac{1}{h} \\ &= \lim_{h \rightarrow 0} \frac{-1}{(x+h+2)(x+2)} \\ &= \frac{-1}{(x+2)^2} \end{aligned}$$

+5

+1 lim  
+1 answer  
+1 setup  
+2 work.

4)



+5

5)  $f(9) = 1.389$

+1

a) In 2020 the population in China will be 1.389 billion.

b)  $h = 0.001 \quad f'(9) \approx 0.00555$  +3  
 $h = 0.0001 \quad f'(9) \approx 0.00554$   
 $h = 0.00001 \quad f'(9) \approx 0.00555$

In 2020 the population increases by 0.00555 billion people. +1 fixed amt not %

6)  $S(5) = 10 \Rightarrow (5, 10)$   
 $V(5) = -2 \Rightarrow S'(5) = -2 \Rightarrow m = -2$

$$y - 10 = -2(x - 5)$$

$y = -2x + 20$

+5