

- (10) 1. Suppose  $f(x) = 2x^2 - 3x$ . Use the **definition of derivative** to find  $f'(x)$ .
- (9) 2. Find an equation for the line tangent to the graph of  $y = \sqrt{x} + 2x^2$  at the point where  $x = 1$ .
- (12) 3. Assume that the functions  $u(x)$  and  $v(x)$  are defined and differentiable for all real numbers  $x$ . The following data is known about  $u$ ,  $v$ , and their derivatives.

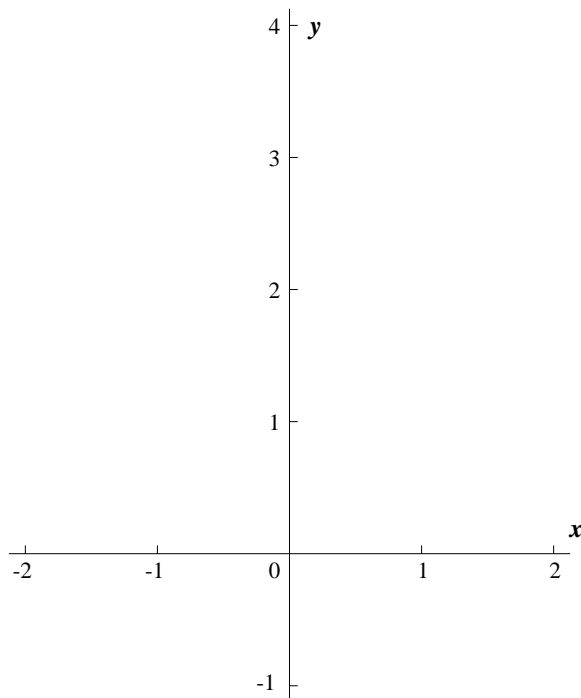
$x$	$u(x)$	$v(x)$	$u'(x)$	$v'(x)$
2	3	4	-1	2
3	2	1	3	-1
4	1	3	0	-2

Define  $f(x) = u(x)^2 + 2v(x)$  and  $g(x) = v(x)/u(x)$ . Answer the following, giving a brief explanation of how the answers were obtained.

- a) What is  $f'(2)$ ?
- b) What is  $g'(3)$ ?
- c) What can be said about the number and location of solutions to the equation  $f(x) = 6.5$  with  $x$  in  $[2, 4]$ ?
- (12) 4. Suppose that the function  $f(x)$  is described by

$$f(x) = \begin{cases} x + B & \text{if } x < 1 \\ Ax + 3 & \text{if } x \geq 1 \end{cases}.$$

- a) Find  $A$  and  $B$  so that  $f(x)$  is continuous for all numbers and  $f(-1) = 0$ . Briefly explain your answer.
- b) Sketch  $y = f(x)$  on the axes given for the values of  $A$  and  $B$  found in a) when  $x$  is in the interval  $[-2, 2]$ .



- (16) 5. Evaluate the indicated limits exactly. Give evidence to support your answers without appealing to calculator computations, to graphing, or to l'Hôpital's Rule.

a)  $\lim_{x \rightarrow 4} \frac{\sqrt{x} - 2}{x - 4}$

b)  $\lim_{x \rightarrow 2^-} \frac{|x - 1| - 1}{|x - 2|}$

c)  $\lim_{x \rightarrow 0} \frac{\sin^2 2x}{x^2}$

d)  $\lim_{x \rightarrow 0} \frac{\cos 3x - 1}{x}$

- (14) 6. In the following, distances are measured in feet and time in seconds. A particle is moving on the  $x$ -axis. Its position at time  $t$  is given by  $s(t) = 2t^3 - 3t^2 - 12t + 7$ .

a) What is the net distance traveled by the particle from  $t = 1$  to  $t = 3$ ?

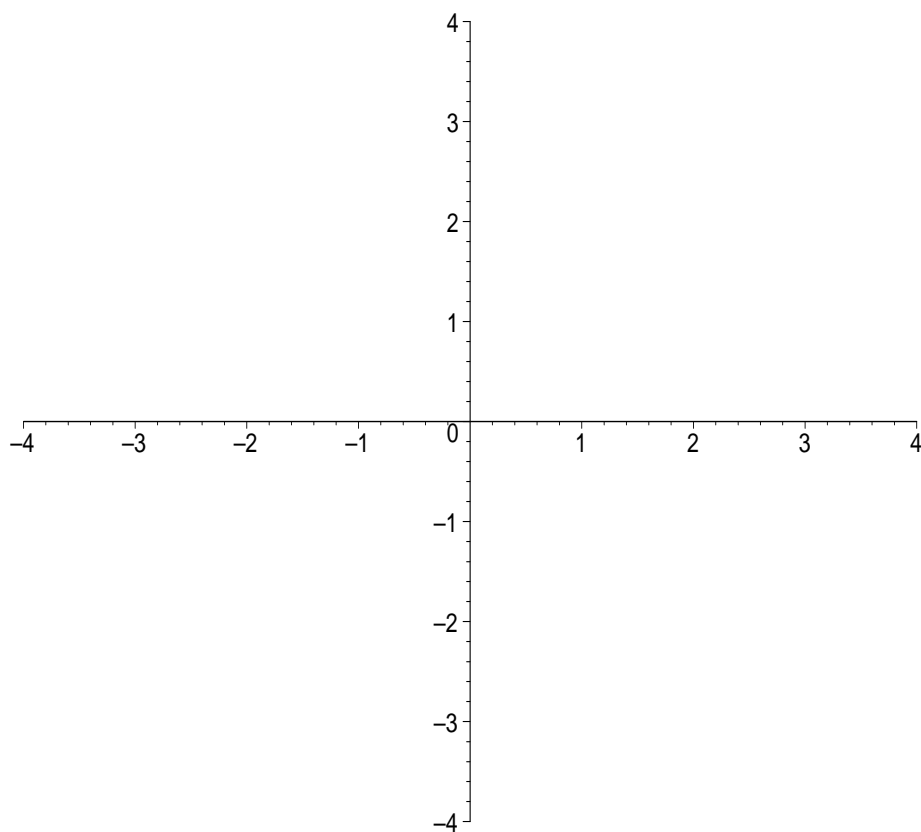
b) What is the total distance traveled by the particle from  $t = 1$  to  $t = 3$ ?

- (10) 7. Solve the following two equations for  $x$ .

a)  $4^{2x-3} = 8^{x+1}$

b)  $\ln(x - 2) + \ln(x + 1) = \ln(3x - 2)$

- (8) 8. (There is no single correct answer to this problem.) On the axes below, sketch the graph of a function  $f(x)$  with all the following properties:
- a) The domain of  $f(x)$  is  $[-4, 4]$ .
  - b)  $f(x)$  is differentiable at all points of its domain except  $x = -1$  and  $x = 2$ .
  - c)  $f(x)$  is not continuous at  $x = -1$ .
  - d)  $f(x)$  is continuous but not differentiable at  $x = 2$ .
  - e)  $f(0) = 1$  and  $f'(0) = -1$ .



(9) 9. a) If  $f(x) = 2x^2\sqrt{x} + \frac{3}{x^3\sqrt{x}}$ , what is  $f'(x)$ ?

b) If  $f(x) = \frac{2 \tan x - 3 \sec x}{\ln x}$ , what is  $f'(x)$ ?

c) If  $f(x) = xe^x \sin x$ , what is  $f'(x)$ ?