

WORKSHEET IV

Interpreting the Derivative

1. Which of the following graphs (a) – (d) could represent the slope at every point of the function graphed below, labeled Figure 2.6?

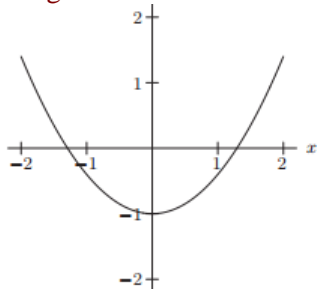
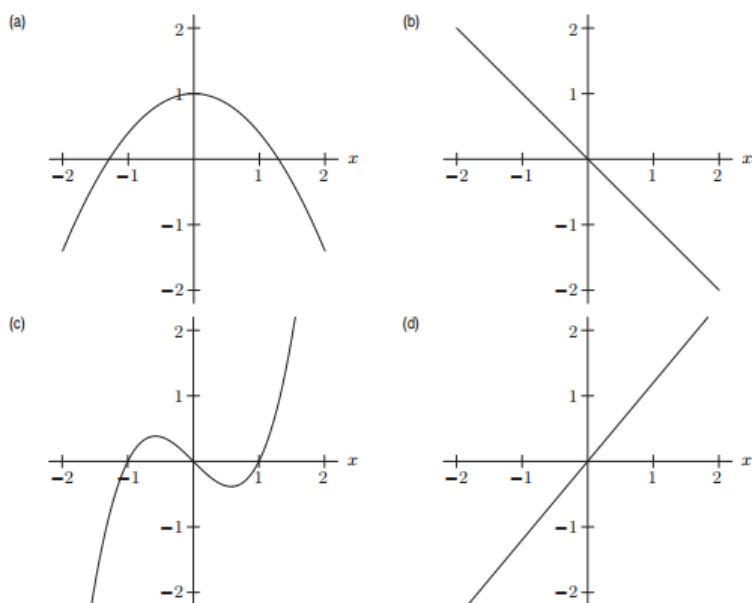


Figure 2.6



2. Give an example of a continuous function which is not everywhere differentiable.
3. Let $f(x) = x|x|$. Is f differentiable at $x = 0$?

4.

Which of the following graphs (a)–(d) could represent the slope at every point of the function graphed in Figure 2.11?

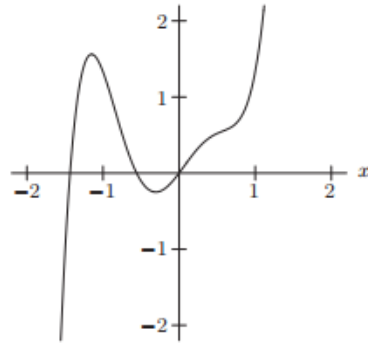
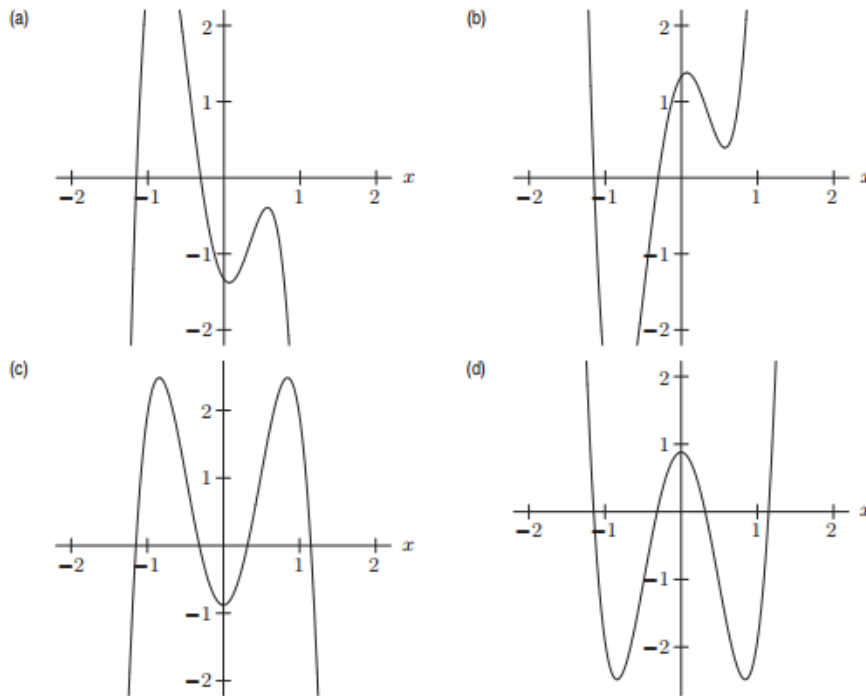


Figure 2.11

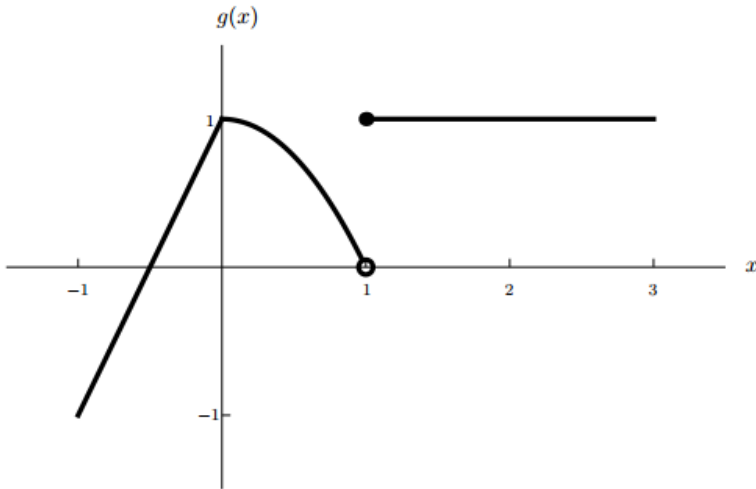


5. Find an equation of the *tangent line* to the given curve at the given point.

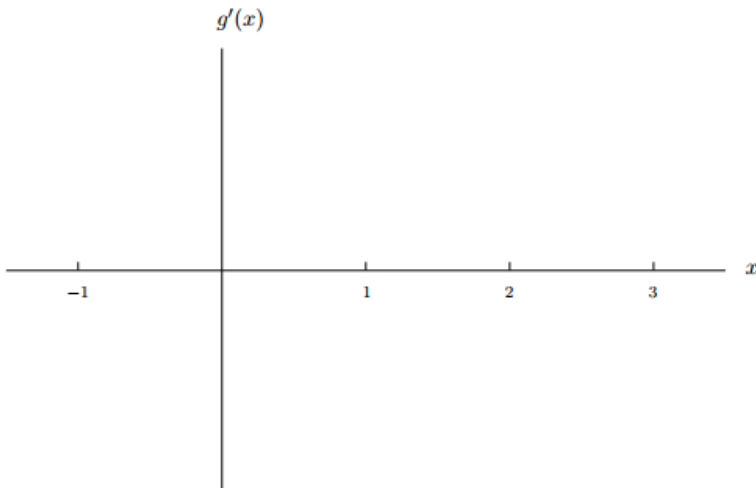
- (a) $y = x^2$, $x = 1$
- (b) $F(x) = 2x^2 + x + 2$, $x = 2$
- (c) $G(x) = 1/x$, $x = 3$
- (d) $y = x^{1/2}$, $x = 4$
- (e) $y = ax^2 + bx + c$, $x = x_0$
- (f) $y = \sin x$, $x = 0$
- (g) $y = 1/(x - 3)^2$, $x = 4$

6.

[10 points] The graph of a function $g(x)$ is given below.



Accurately sketch a graph of $g'(x)$ on the axes below. Be sure to label the vertical axis.



7. The function $C(r)$ is the total cost, in dollars, of paying off a car loan borrowed at an interest rate of r % per year.

What are the units of $C'(r) = \frac{dC}{dr}$?

- (a) Year/\$ (b) \$/Year (c) \$/(%/Year) (d) (%/Year)/\$

What is the practical meaning of $C'(5)$?

- (a) The rate of change of the total cost of the car loan is $C'(5)$.
(b) If the interest rate increases by 1%, then the total cost of the loan increases by about $C'(5)$.
(c) If the interest rate increases by 1%, then the total cost of the loan increases by about $C'(5)$ when the interest rate is 5%.
(d) If the interest rate increases by 5%, then the total cost of the loan increases by about $C'(5)$.

What is the sign of $C'(5)$?

- (a) Positive
(b) Negative
(c) Not enough information

8. The temperature, Y , in Fahrenheit, of a cold yam placed in a hot oven is given by $Y = g(t)$, where t is the time in minutes since the yam was placed into the oven.

- (a) What is the sign of $g'(t)$? Why?
(b) What are the units of $g'(20)$? What is the *practical meaning* of the statement $g'(20) = 2$?

9. For some painkillers, the size of the dose, D , given depends upon the weight of the patient, W . Thus, $D = H(W)$, where D is in milligrams and W is in pounds.

- (a) Interpret the statements $H(140) = 120$ and $H'(140) = 3$ in terms of this painkiller.
(b) Use the information in the statements in part (a) to estimate $H(145)$.

10. Suppose that $C(T)$ is the cost of heating Albertine's house, in dollars per day, when the *outside* temperature is T degrees Fahrenheit.

- (a) What does $C(19) = 8.67$ mean in practical terms? (Use appropriate units.)
(b) What does $C'(19) = -0.55$ mean in practical terms? (Use appropriate units.)
(c) If $C(19) = 8.67$ and $C'(19) = -0.55$, approximately what is the cost of heating Albertine's house when the outside temperature is 16 degrees Fahrenheit? (Use appropriate units.)

11. The cost C (in thousands of dollars) of building a house that is x square feet is given by the function $C = F(x)$.

- (a) Explain the *meaning* of the statement: $F(1600) = 140$.
(b) Give the *practical interpretation* of the statement: $F'(1600) = 0.1$.
(c) Using the information given in parts (a) and (b), *estimate* the cost of building a house that is 1680 square feet.

Charles Hermite



Charles Hermite à la fin de sa vie

I turn away with fright and horror from the lamentable evil of functions which do not have derivatives.

- Charles Hermite (in a letter to Thomas Jan Stieltjes)

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