

Example 11 A price increase can be significant or inconsequential depending on the item. In each of the following cases, find the relative change in price of a \$2 price increase; give your answer as a percent.

- (a) A gallon of gas costing \$2.25 (b) A cell phone costing \$180

Solution (a) The change in the price is \$2 so we have

$$\text{Relative change in price of gas} = \frac{\text{Change in price}}{\text{Initial price}} = \frac{2}{2.25} = 0.889.$$

The price of gas has gone up 88.9%.

(b) We have

$$\text{Relative change in price of cell phone} = \frac{\text{Change in price}}{\text{Initial price}} = \frac{2}{180} = 0.011.$$

The price of the cell phone has gone up only 1.1%.

Relative change can be positive or negative, as we see in the following example.

Example 12 Find the relative change in the price of a \$75.99 pair of jeans if the sale price is \$52.99.

Solution The price has dropped from \$75.99 to \$52.99. We have

$$\text{Relative change} = \frac{52.99 - 75.99}{75.99} = \frac{-23}{75.99} = -0.303.$$

The price has been reduced by 30.3% for the sale.

Problems for Section 1.3

In Problems 1–4, decide whether the graph is concave up, concave down, or neither.

In Problems 5–8, find the relative, or percent, change.

5. S changes from 400 to 450

6. B changes from 12,000 to 15,000

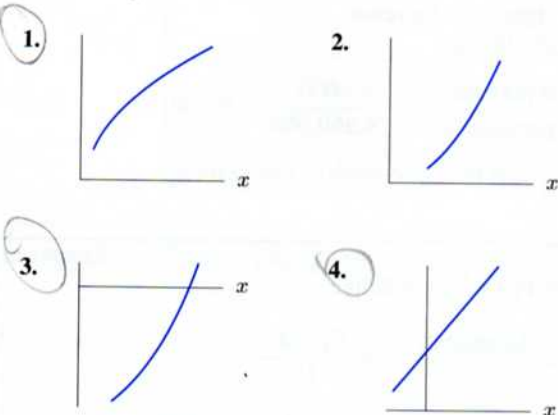
7. R changes from 50 to 47

8. W changes from 0.3 to 0.05

9. Table 1.10 gives values of a function $w = f(t)$. Is this function increasing or decreasing? Is the graph of this function concave up or concave down?

Table 1.10

t	0	4	8	12	16	20	24
w	100	58	32	24	20	18	17



10. For which pairs of consecutive points in Figure 1.33 is the function graphed:
- (a) Increasing and concave up
 - (b) Increasing and concave down
 - (c) Decreasing and concave up
 - (d) Decreasing and concave down

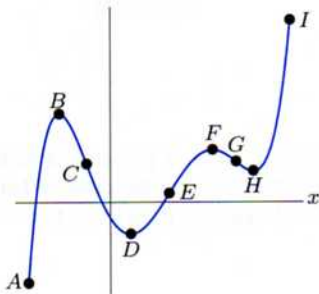


Figure 1.33

11. Graph a function $f(x)$ which is increasing everywhere and concave up for negative x and concave down for positive x .
12. Find the average rate of change of $f(x) = 2x^2$ between $x = 1$ and $x = 3$.
13. Find the average rate of change of $f(x) = 3x^2 + 4$ between $x = -2$ and $x = 1$. Illustrate your answer graphically.
14. When a deposit of \$1000 is made into an account paying 8% interest, compounded annually, the balance, B , in the account after t years is given by $B = 1000(1.08)^t$. Find the average rate of change in the balance over the interval $t = 0$ to $t = 5$. Give units and interpret your answer in terms of the balance in the account.
15. Table 1.11 shows world bicycle production.²⁸
- (a) Find the change in bicycle production between 1950 and 2000. Give units.
 - (b) Find the average rate of change in bicycle production between 1950 and 2000. Give units and interpret your answer in terms of bicycle production.

Table 1.11 World bicycle production, in millions

Year	1950	1960	1970	1980	1990	2000
Bicycles	11	20	36	62	92	101

16. Table 1.12 gives the net sales of The Gap, Inc, which operates nearly 3000 clothing stores.²⁹
- (a) Find the change in net sales between 2005 and 2008.
 - (b) Find the average rate of change in net sales between 2005 and 2008. Give units and interpret your answer.
 - (c) From 2003 to 2008, were there any one-year intervals during which the average rate of change was positive? If so, when?

Table 1.12 Gap net sales, in millions of dollars

Year	2003	2004	2005	2006	2007	2008
Sales	15,854	16,267	16,019	15,923	15,763	14,526

17. Table 1.13 shows attendance at NFL football games.³⁰

- (a) Find the average rate of change in the attendance from 2003 to 2007. Give units. *error in sol m*
- (b) Find the annual increase in the attendance for each year from 2003 to 2007. (Your answer should be four numbers.)
- (c) Show that the average rate of change found in part (a) is the average of the four yearly changes found in part (b).

Table 1.13 Attendance at NFL football games, in millions of fans

Year	2003	2004	2005	2006	2007
Attendance	21.64	21.71	21.79	22.20	22.26

18. Figure 1.34 shows the total value of US imports, in billions of dollars.³¹
- (a) Was the value of the imports higher in 1985 or in 2003? Approximately how much higher?
 - (b) Estimate the average rate of change of US imports between 1985 and 2003. Give units and interpret your answer in terms of imports.

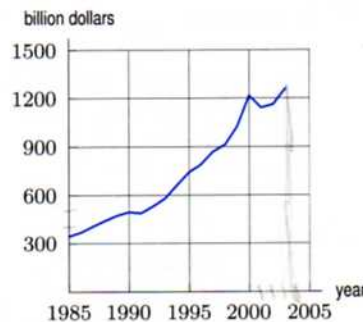


Figure 1.34

²⁸ www.earth-policy.org/Indicators/indicator11_data1.htm, accessed April 19, 2005.
²⁹ www.gapinc.com/public/investors/inv_financials.shtml/ accessed May 24, 2009.
³⁰ *Statistical Abstracts of the United States 2009, Table 1204.*
³¹ www.ita.doc.gov/td/industry/otea/usfth/aggregate/H03t26.pdf, accessed April 19, 2005.