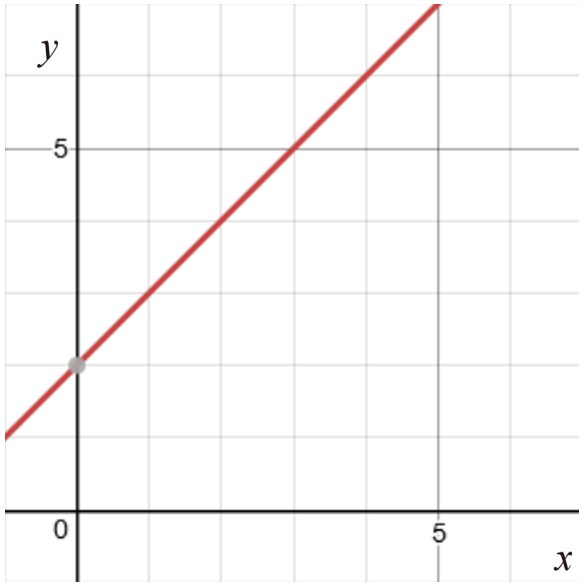
Moving Along a Function

Consider the function $y = x + 2$.



It is a relationship between the variables x and y. When we change x, we are also changing y, and vice versa. For instance, it contains the points

- $(0, 2)$
- $(1, 3)$
- $(2, 4)$

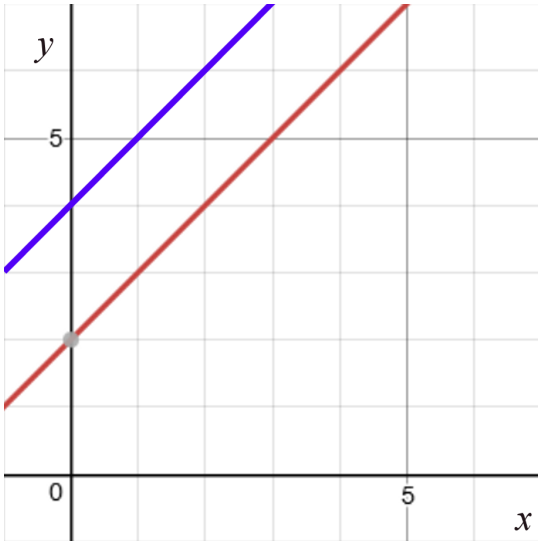
If we change either x or y, then we move to a different point on the function.

Shifting a Function

Again, consider the function $y = x + 2$. **If we change something in the function other than the plot variables x and y, then we shift the function.**

For instance, suppose the function changes to $y = x + 4$. Then we have a new y value for each x value, in particular,

- $(0, 4)$
- $(1, 5)$
- $(2, 6)$



Ratios and Growth

- A **ratio** is the amount of what is in the numerator per unit of what is in the denominator. For example, if you work 40 hours and earn \$400 in that time, then your wage-per-hour is

$$\frac{\$400}{40 \text{ hours}} = \$10 \text{ per hour.}$$

- A **rate of change** is a ratio that tells us by what percentage something has changed. For example, if I ate 2 pizzas yesterday and 5 pizzas today, then my pizza consumption has changed by

$$g_x = \frac{\text{new value} - \text{old value}}{\text{old value}} = \frac{5-2}{2} = 1.5.$$

  In other words, from yesterday to today, my consumption of pizza has grown by 150%.

- The **change in x**, defined as the new value minus the old value, can thus be found with

$$\Delta x = g_x \times \text{old value} = \text{new value} - \text{old value.}$$

Present and Future Value

- The **future value** tells you what the value of a present variable will be in the future given the growth rate:

$$\text{current value} \times (1 + g_x) = \text{future value}.$$

Suppose you can invest \$100 today at an annual interest rate of 10%. Then the future value (one year from now) of your present \$100 is

$$(1 + 0.10) \times \$100 = \$110.$$

- The **present value** tells you what the value of a future variable is in today's terms, given the growth rate:

$$\text{present value} = \frac{\text{future value}}{(1 + g_x)}.$$

Suppose you are told that you will receive \$110 one year from now, and the interest rate over that period will be 10%. Then the present value of that future \$110 is

$$\frac{\$110}{(1 + 0.10)} = \$100.$$

Growth Examples

Example 1. The U.S. population in 1980 was 226 million. Today it is 323 million. What is the growth rate of the population over this period?

$$\frac{323 - 226}{226} = \frac{97}{226} \approx 43\%.$$

Example 2. The median U.S. salary in 2010 was $48,691. In 1990 it was $28,680. What is the growth rate of the median U.S. salary over this period?

$$\frac{48,691 - 28,680}{28,680} = \frac{20011}{28,680} \approx 70\%.$$

Example 3. The **consumer price index** attempts to capture how much money a typical consumer spends in a month, i.e. the "price level" of the economy. In 1980, the CPI was 77.8. Today, the CPI is 245. By how much did the price level increase over this period? (A rise in the price level is known as **inflation**, typically expressed as a percentage change.)

$$\frac{245 - 77.8}{77.8} = \frac{167.2}{77.8} \approx 215\%.$$

Problem 1. Which of the following will be included in 2009 GDP?

(a) The value of a bookshelf that you build for yourself in 2009

(b) The value of a boat that is produced in 2008 and sold in 2009

(c) The value of a textbook that is produced in 2009 but not sold

(d) The value of a used car that is sold in 2009

(e) None of the above

Problem 2. What is the main reason why national-income accountants estimate GDP using the values of the final goods rather than the value of all the goods produced in a year?

(a) To include all the goods produced in GDP, but only once.

(b) To exclude the values of all the intermediate goods produced from GDP.

(c) To exclude the values of all the assets purchased from GDP.

(d) To include the values of all the imported goods purchased in GDP.

(e) None of the above

Problem 3. Which of the following will NOT be included in 2009 GDP?

(a) The value of lawn mower engines that Briggs and Stratton made in 2009 but could not sell.

(b) The value of a computer chip produced in 2009 and used in the production of a personal computer.

(c) The value of a piece of land Brad sold to Abe in 2009.

(d) The value of a computer chip produced in 2009 that was not used in any personal computer.

(e) None of the above

Year	Good 1		Good 2	
	Price	Quantity	Price	Quantity
2007	$2	4	$6	2
2008	$3	5	$7	3
2009	$4	8	$8	5

Problem 4. The table above shows the prices and quantities of the two goods produced in a country in 2007, 2008, and 2009. These are the only goods produced in the country. What is nominal GDP in 2007?

Problem 5. The table above shows the prices and quantities of the two goods produced in a country in 2007, 2008, and 2009. These are the only goods produced in the country. Using 2008 as the base year, what is real GDP in 2007?

Problem 6. Same thing as before. These are the only goods produced in the country. Using 2008 as the base year, what is the GDP deflator in 2007?

Ander's Burgers	
revenue	$200,000
Costs	
Meat	$20,000
Hamburger Buns	$5,000
Wages	$75,000
Interest	$15,000
rent	$25,000

Problem 7. The table above shows the revenue received and costs incurred by Ander's hamburger restaurant over the last year. What was Ander's restaurant's value added?

Problem 8. The table above shows the revenue received and costs incurred by Ander's hamburger restaurant over the last year. What was Ander's restaurant's profit?

Problem 9. You bought an old apartment complex in San Francisco for $10 million in 2009 and sold it the same year for $11 million. The real estate agent received a fee of $1.2 million for the two transactions combined. What was the contribution of all of these transactions to the 2009 GDP?

Problem 10. Suppose 2005 is the base year. In 2006 the prices of all goods and service produced increase by 5% over their 2005 values. Assuming that the same goods and services are produced in both years (although not necessarily in the same quantities), what can we say about the 2006 real GDP?

(a) The 2006 real GDP will be higher than the 2005 real GDP by 5%

(b) The 2006 real GDP will be lower than the 2005 real GDP by 5%

(c) The 2006 real GDP will be the same as the 2005 real GDP

(d) Need more information to answer

(e) None of the above

Problem 11. Suppose 2005 is the base year. In 2006 the prices of all goods and service produced increase by 5% over their 2005 values. Assuming that the same goods and services are produced in both years (although not necessarily in the same quantities), what can we say about the 2006 nominal GDP (NGDP)?

(a) The 2006 NGDP will be higher than the 2005 real GDP by 5%

(b) The 2006 NGDP will be lower than the 2005 real GDP by 5%

(c) The 2006 NGDP will be the same as the 2005 real GDP

(d) Need more information to answer

Problem 12. Suppose 2005 is the base year. In 2006 the prices of all goods and service produced increase by 5% over their 2005 values. Assuming that the same goods and services are produced in both years (although not necessarily in the same quantities), what can we say about the 2006 GDP deflator?

(a) The 2006 GDP deflator will be 105

(b) The 2006 GDP deflator will be 100

(c) The 2006 GDP deflator will be 95

(d) Need more information to answer

Problem 13. Suppose that an average household in a small island country consumed only three goods. The following table shows the prices and quantities of these goods for three different years.

	Good 1		Good 2		Good 3	
Year	P	Q	P	Q	P	Q
1984	$20.00	2	$30.00	5	$10.00	6
2006	$40.00	4	$60.00	7	$20.00	8
2015	$49.00	4	$71.00	7	$23.00	8

Assume that 1984 is the base year. What is the consumer price index (CPI) for 2006?