

## Bonus Chapter 4

# Performing Transformations

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### *In This Chapter*

- ▶ Translating figures
  - ▶ Reflecting figures
  - ▶ Rotating figures
  - ▶ Dilating figures
- .....

**C**abri Jr. has all the tools you need to transform your geometric constructions by translating, reflecting, rotating, or dilating them. This chapter tells you how to use these tools.

## *Translating a Geometric Object*

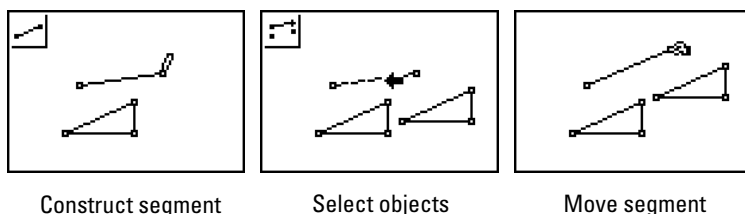
When you translate a geometric object, you move it in a given direction for a given distance. To get Cabri Jr. to do this for you, you use a segment to tell Cabri Jr. the direction in which to move the object. The length of the segment tells Cabri Jr. how far to move the object.

To translate an already constructed geometric object, follow these steps:

- 1. Construct the segment giving the direction and length of the translation.**

Constructing segments is explained in Chapter 9. The order in which the endpoints of the segment are constructed determines the direction of the translation. In the first picture in Figure B4-1, the pencil is located at the last point made in the construction of the segment. So the direction

of the translation will be the direction from the first (left) point of the segment to the last point where the pencil is located.



**Figure B4-1:** Translating a triangle.

2. Press **TRACE** to access the F4 Transformation menu. Use **▲▼** to move the cursor to the Translation option and press **ENTER** to select that option.

A symbol of the tool appears in the upper-left corner of the screen, as illustrated in the second picture of Figure B4-1.

3. Use the arrow keys to place the cursor on the object to be translated and press **ENTER** to select that object.

Cabri Jr. can translate only one object at a time. The object to be translated blinks when the cursor is placed on it. When selecting a triangle or quadrilateral, all sides of the object must be blinking to select the whole object instead of just one side of the object. To do this, place the cursor inside the object and move it slightly until all sides are blinking.

4. Use the arrow keys to move the cursor to the segment and press **ENTER**.

The translation of the original object appears along with the original object, as illustrated in the second picture in Figure B4-1.

5. Repeat Steps 3 and 4 to translate more objects. When you are finished translating objects, press **CLEAR** or select another menu item.



After translating objects, if you move the segment, the translated objects will move to the location defined by the new segment, as illustrated in the third picture in Figure B4-1. If you delete one of the endpoints of the segment, the translated object is also deleted. Moving and deleting objects is explained in Chapter 9.

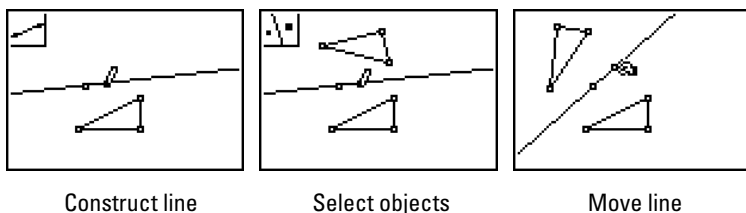
## Reflecting Geometric Objects

When a geometric object is reflected in a line, that line acts like a mirror — hence the term “reflection.” The mirror image of the original object appears on the other side of the line. Cabri Jr. allows objects to be reflected in a line or a segment.

To reflect an already constructed geometric object, follow these steps:

### 1. Construct the line (or segment) of reflection.

Constructing lines and segments is explained in Chapter 9. The first picture in Figure B4-2 shows that the already constructed triangle is to be reflected in a line.



**Figure B4-2:** Reflecting an object.

### 2. Press **TRACE** to access the F4 Transformation menu. Use **↑** **↓** to move the cursor to the Reflection option and press **ENTER** to select that option.

A symbol of the tool appears in the upper-left corner of the screen, as illustrated in the second picture of Figure B4-2.

### 3. Use the arrow keys to place the cursor on the object to be reflected and press **ENTER** to select that object.

Cabri Jr. can reflect only one object at a time. The object to be reflected blinks when the cursor is placed on it. When selecting a triangle or quadrilateral, all sides of the object must be blinking to select the whole object instead of just one side of the object. To do this, place the cursor inside the object and move it slightly until all sides are blinking.

### 4. Use the arrow keys to move the cursor to the segment and press **ENTER**.

The reflection of the original object appears along with the original object, as illustrated in the second picture in Figure B4-2.

5. Repeat Steps 3 and 4 to reflect more objects. When you are finished reflecting objects, press **CLEAR** or select another menu item.



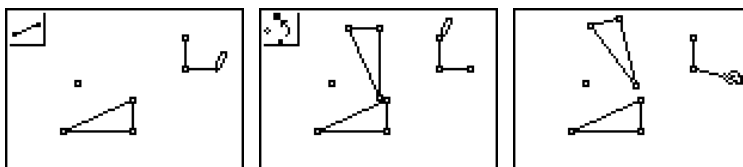
After reflecting objects, if you move the line (segment) of reflection, the reflected objects will move to the location defined by the new line or segment, as illustrated in the third picture in Figure B4-2. Moving objects is explained in Chapter 9.

## Rotating Geometric Objects

When a geometric object is rotated, it is rotated about a given point through a given angle. To rotate an already constructed geometric object, follow these steps:

1. Construct the point of rotation and construct the three points that determine the angle of rotation.

Constructing points is explained in Chapter 9. The point about which rotation occurs can be one of the points on the already constructed object. The first picture in Figure B4-3 shows that the already constructed triangle is to be rotated about the point above the triangle. The angle through which it is to be rotated appears in the upper-right corner of the screen. Your angle does not have to have sides like the angle in this picture. All that is needed are three points.



Construct point and angle

Select objects

Move angle

**Figure B4-3:** Rotating a triangle about a point.

2. Press **TRACE** to access the F4 Transformation menu. Use **↑** and **↓** to move the cursor to the Rotation option and press **ENTER** to select that option.

A symbol of the tool appears in the upper-left corner of the screen, as illustrated in the second picture of Figure B4-3.

3. Use the arrow keys to place the cursor on the object to be rotated and press **ENTER** to select that object.

Cabri Jr. can rotate only one object at a time. The object to be rotated blinks when the cursor is placed on it. When selecting a triangle or quadrilateral, all sides of the object must be blinking to select the whole object instead of just one side of the object. To do this, place the cursor inside the object and move it slightly until all sides are blinking.

4. Use the arrow keys to move the cursor to the center of rotation and press **ENTER**.
5. For each point defining the angle of rotation, use the arrow keys to move the cursor to that point, and then press **ENTER** to select the point. The vertex must be the second point selected.

The rotation of the original object appears along with the original object, as illustrated in the second picture in Figure B4-3.

6. Repeat Steps 3 through 5 to rotate more objects. When you are finished rotating objects, press **CLEAR** or select another menu item.



After rotating objects, if you move the center of rotation or one of the points defining the angle of rotation, the rotated object moves to the location determined by the new center of rotation or by the new angle of rotation, as illustrated in the third picture in Figure B4-3. Moving objects is explained in Chapter 9.



The **Symmetry** tool in the **F4 Transformation** menu can be used to rotate an object 180 degrees about a given point. This tool works just like the **Rotation** tool, except you don't have to define the angle because this tool uses a 180 degree angle.

## *Dilating Geometric Objects*

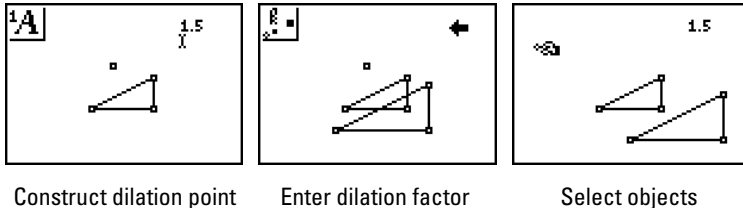
The **Dilation** tool in the in the **F4 Transformation** menu is used to increase or decrease the size of an object by a factor of  $k$ . When  $0 < k < 1$ , the object decreases in size, and when  $k > 1$ , it increases in size. For example, if  $k = 0.5$ , the dilated object is half its original size, and if  $k = 2$ , the dilated object doubles in size. Guess what it does when  $k = 1$ ? That's right; the object doesn't change at all.

The dilation of an object also takes place with respect to a fixed point (the *dilation point*). If that point is at the center of the object, such as the center of a circle, the object increases or decreases in size and the center of the object remains fixed. But when the dilation point is not in the center of the object, not only does the object increase or decrease in size, but it also moves away from the dilation point when  $k > 1$  or closer when  $0 < k < 1$ . The distance that the dilated object moves is determined by  $k$ . For example, if  $k = 2$ , the dilated object doubles in size and is twice as far away for the dilation point.

To dilate an already constructed geometric object, follow these steps:

### 1. Construct the dilation point.

Constructing points is explained in Chapter 9, and the meaning of the dilation point is explained earlier in this section. The dilation point can be one of the points on the already constructed object. The first picture in Figure B4-4 shows that the already constructed triangle is to be dilated with respect to a point outside the triangle.



Construct dilation point

Enter dilation factor

Select objects

**Figure B4-4:** Dilating a triangle with respect to a point.

### 2. Use the Alpha-Num tool in the F5 Appearance menu to place the value of the dilation factor $k$ anywhere on the screen.

To do this, press **GRAPH** to access the Appearance menu. Use **▲▼** to move the cursor to the Alpha-Num option and press **ENTER** to select that option. Move the cursor to an out-of-the-way location on the screen and press **ENTER**. Press **ALPHA** and use the keypad to enter the value of the dilation factor  $k$  and press **ENTER**. This is illustrated in the first picture in Figure B4-4, where the dilation factor is placed in the upper-right corner of the screen.

3. Press **TRACE** to access the F4 Transformation menu. Use **↑** **↓** to move the cursor to the Dilation option and press **ENTER** to select that option. Then use the arrow keys to move the cursor to the object you want to dilate and press **ENTER**.

Cabri Jr. can dilate only one object at a time. The object to be dilated blinks when the cursor is placed on it. When selecting a triangle or quadrilateral, all sides of the object must be blinking to select the whole object instead of just one side of the object. To do this, place the cursor inside the object and move it slightly until all sides are blinking.

4. Use the arrow keys to move the cursor to the dilation point and press **ENTER**. Then use the arrow keys to move the cursor to the dilation factor you entered in Step 2 and press **ENTER**.

The original object and the dilation of the object appear on the screen, as illustrated in the second picture in Figure B4-4.

5. Repeat Steps 3 and 4 to dilate more objects. When you are finished dilating objects, press **CLEAR** or select another menu item.



After dilating objects, if you move the center of dilation, the dilated object moves to the location determined by the new center, as illustrated in the third picture in Figure B4-4. Moving objects is explained in Chapter 9.

