z score. For example, the shoe print lengths have a mean of $\bar{x} = 30.04$ cm and a standard deviation of $s_x = 1.66823$ cm, so the first shoe print length of 29.7 cm is converted to a z score of -0.20381 as shown here:

$$z_x = \frac{x - \bar{x}}{s_x} = \frac{29.7 - 30.04}{1.66823} = -0.20381$$

Table 10-3 lists the z scores for all of the shoe print lengths (see the third column) and the z scores for all of the heights (see the fourth column). The last column of Table 10-3 lists the products $z_x \cdot z_y$.

Table 10-3 Calculating r with Formula 10-2

x (Shoe Print)	y (Height)	z_x	z_y	$z_x \cdot z_y$
29.7	175.3	-0.20381	-0.41035	0.08363
29.7	177.8	-0.20381	0.10259	-0.02091
31.4	185.4	0.81524	1.66191	1.35485
31.8	175.3	1.05501	-0.41035	-0.43292
27.6	172.7	-1.46263	-0.94380	1.38043
				$\Sigma(z_x \cdot z_y) = 2.36508$

Using $\Sigma(z_x \cdot z_y) = 2.36508$ from Table 10-3, the value of r is calculated by using Formula 10-2 as shown below.

$$r = \frac{\Sigma(z_x \cdot z_y)}{n - 1} = \frac{2.36508}{4} = 0.591$$

Is There a Linear Correlation?

We know from the preceding three examples that the value of the linear correlation coefficient is $r = 0.591$ for the sample data in Table 10-1. We now proceed to interpret its meaning, and our goal is to decide whether there appears to be a linear correlation between shoe print lengths and heights of people. Using the criteria given in the preceding box, we can base our interpretation on a P-value or a critical value from Table A-6. See the criteria for "Interpreting the Linear Correlation Coefficient r" given in the preceding box.

Example 4 **Is There a Linear Correlation?**

In Examples 1, 2, and 3, we used the sample data from Table 10-1 to find that $r = 0.591$. If we use a significance level of 0.05, is there sufficient evidence to support a claim that there is a linear correlation between shoe print lengths and heights of people?

Solution

Requirement check The requirement check in Example 1 also applies here. ✓

We can base our conclusion about correlation on either the P-value obtained from computer software or the critical value found in Table A-6. (See the