| EXAMPLE 4 | **Finding the Probability of an Event** |

You are an actuary for a retirement pension company. When a person retires at age 65, you use the following table to help determine the amount the person can withdraw monthly from his or her account.

Probability of Person Age 65 Living to Certain Age		
Age	Male	Female
80	59%	70%
85	38%	51%
90	19%	30%
95	6%	12%

For some retirement accounts, a person can take the option of having monthly withdrawals (at a lesser amount) as long as the person *or* the person's spouse survives. Consider a man and a woman who are each 65 years old.

a. What is the probability that at least 1 of them lives to age 80?

b. What is the probability that at least 1 of them lives to age 90?

SOLUTION

When analyzing questions like these, be sure that you do not start multiplying probabilities without thinking carefully. For instance, in these questions it is easier to work with the probability that both people *do not* survive.

a.

Probability that both *do not* survive to age 80

$$= \overset{\text{Man}}{(1 - 0.59)}\overset{\text{Woman}}{(1 - 0.70)} = 0.123 \quad \text{Age 80}$$

Probability that at least one *does* survive to age 80

$$= 1 - 0.123 = 0.877$$

So, there is an 87.7% chance that at least 1 will survive to age 80.

b.

Probability that both *do not* survive to age 90

$$= \overset{\text{Man}}{(1 - 0.19)}\overset{\text{Woman}}{(1 - 0.30)} = 0.567 \quad \text{Age 90}$$

Probability that at least one *does* survive to age 90

$$= 1 - 0.567 = 0.433$$

So, there is a 43.3% chance that at least 1 will survive to age 90.

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Rework the probabilities in the above example in the case that (c) both people are women and (d) both people are men.