Section 4.2

Least-Squares Regression

Finding the Equation for a Line

Another very important skill is finding the equation for a line. In particular, it's important for us to know how to find the equation when we're given two points.

A very useful equation to know is the point-slope form for a line.

> The **point-slope form** of a line is
>
> $$y - y_1 = m(x - x_1)$$
>
> where m is the slope of the line and (x_1, y_1) is a point on the line.

Let's practice using this form to find an equation for the line.

Example 2

In Example 1 from section 4.1, we talked about the relationship between student heart rates (in beats per minute) before and after a brisk walk.

before	after	before	after	before	after
86	98	58	128	60	70
62	70	64	74	80	92
52	56	74	106	66	70
90	110	76	84	80	92
66	76	56	96	78	116
80	96	72	82	74	114
78	86	72	78	90	116
74	84	68	90	76	94

Let's highlight a pair of points on that plot and use those two points to find an equation for a line that might fit the scatter diagram.

Using the points (52, 56) and (90, 116), we get a slope of

$$m = \frac{116-56}{90-52} = \frac{60}{38} \approx 1.58$$

So an equation for the line would be:

$$y - y_1 = m(x - x_1)$$

$$y - 56 = 1.58(x - 52)$$

$$y - 56 = 1.58x - 82.16$$

$$\mathbf{y = 1.58x - 26.16}$$

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66	76	56	96	78	116
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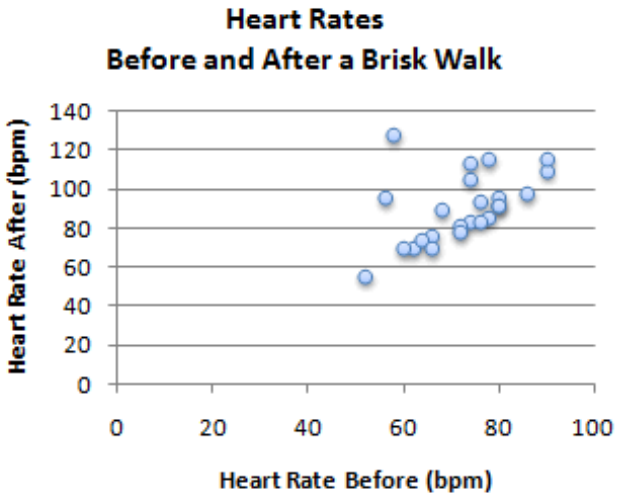

Using computer software, we find the following values:

$\bar{x}$ ≈72.16667
s_x ≈10.21366
$\bar{y}$ = 90.75
s_y ≈17.78922
r ≈ 0.48649

Note: We don't want to round these values here, since they'll be used in the calculation for the correlation coefficient - only round at the very last step.

Using the formulas for the LSR line, we have

$$\hat{y} = 0.8473x + 29.6018$$

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