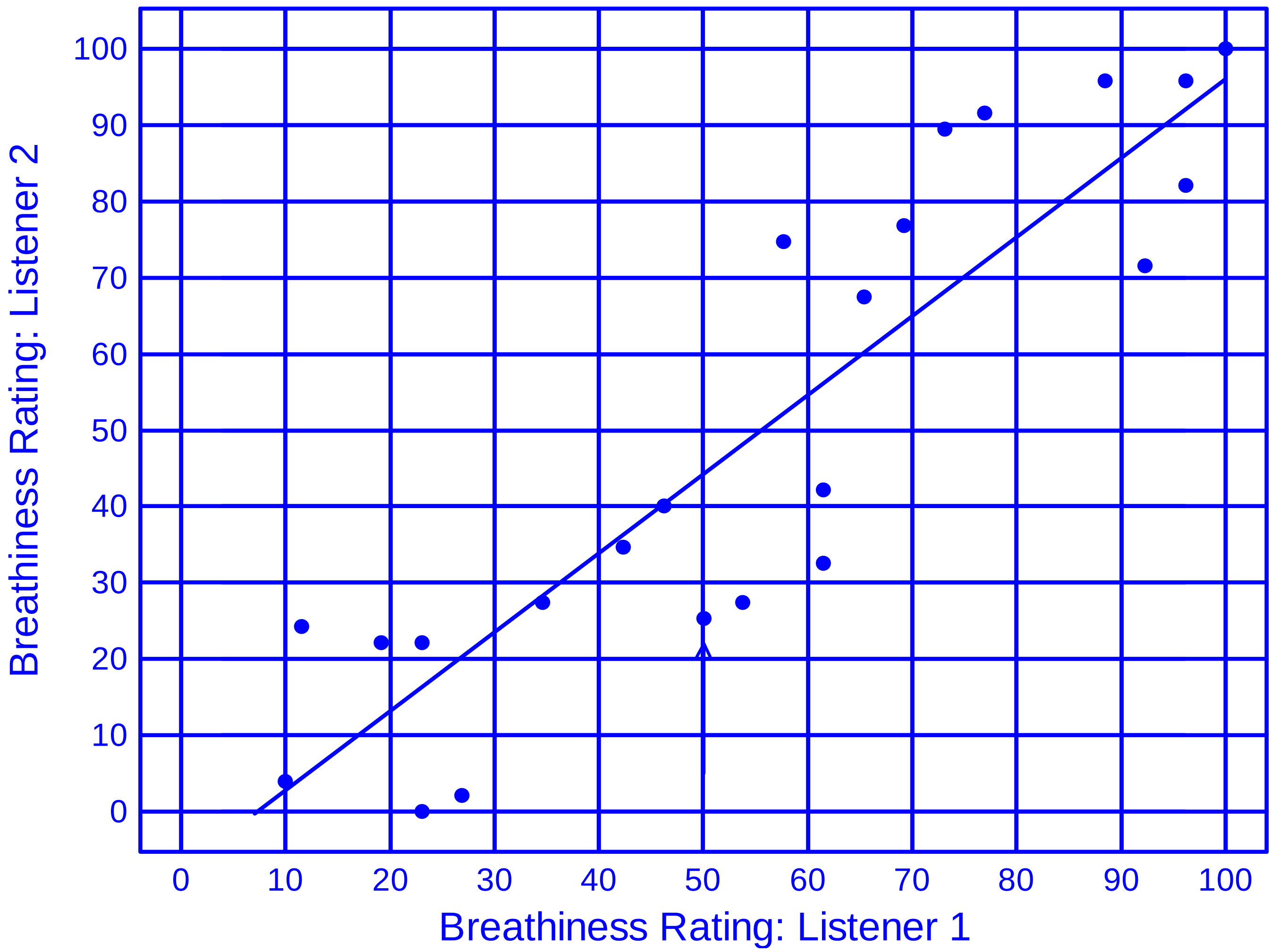
<u>Standard Error of Estimate Example</u>

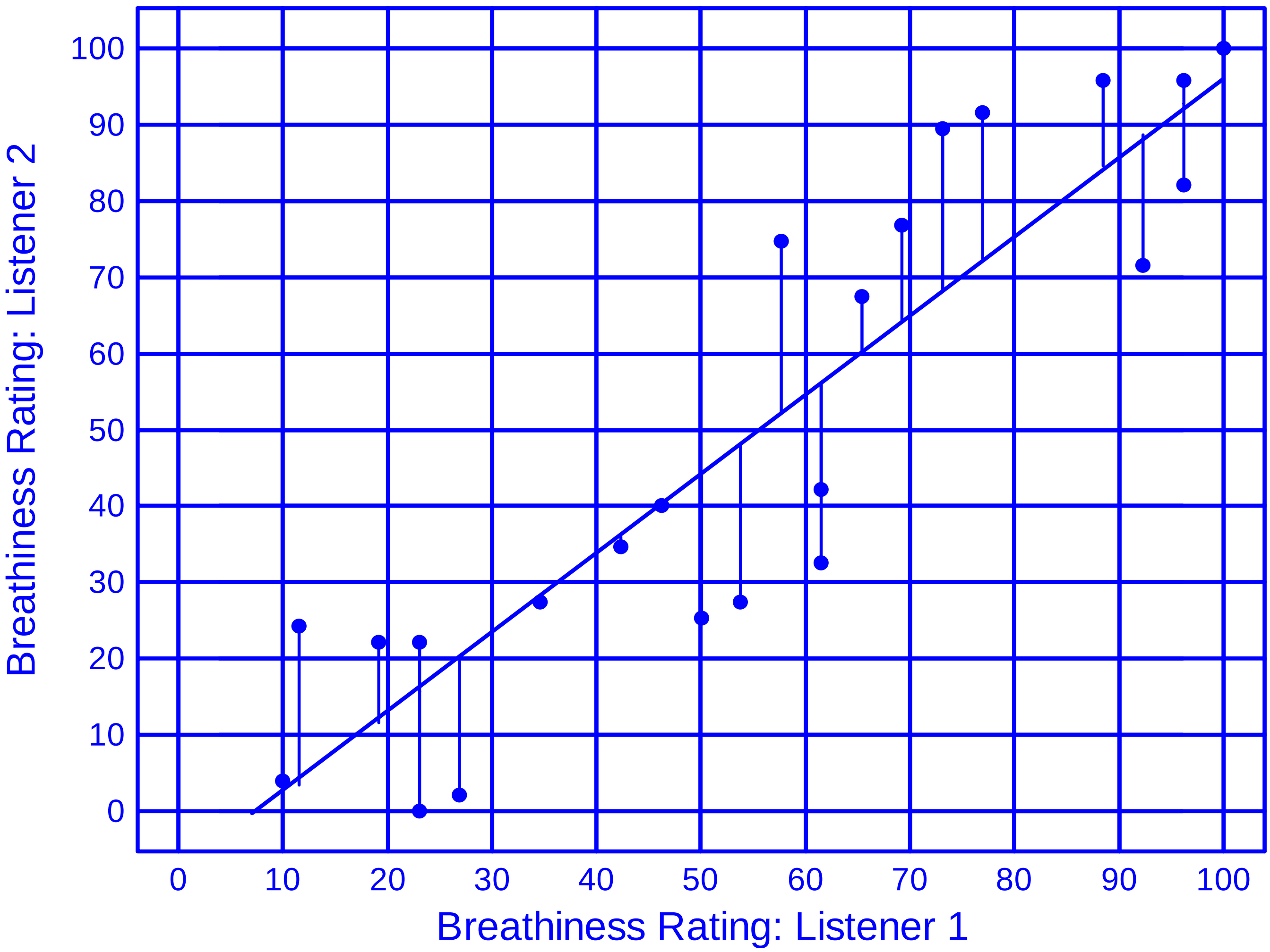
Use the attached figure and the table below to calculate the standard error of estimate. The data are from a reliability study in which two listeners provided independent judgments of breathiness for a set of 23 voices. Each dot on the scatter plot shows the rating provided by listener 1 and the rating of the same voice provided by listener 2. The height of each dot on the y axis is the measured y value; i.e., the actual rating provided by listener 2. All values on the regression line correspond to predicted y values, also known as y' (y prime). For example, notice that there is a voice that was given a breathiness rating of exactly 50 by listener 1, and the same voice was given a breathiness rating of about 25 by listener 2 (see the arrow in the figure – this is also data point number 2 in the table below). Our most accurate predictions of listener 2's ratings based on a knowledge of listener 1's ratings are summarized by the regression line. Eyeballing the figure, the *predicted* listener 2 rating is about 45 (start at 50 on the x axis and go up until you hit the regression line). From line 2 of the table below you can see that the actual y' value for this data point is 45.671. The prediction error for this data point is therefore (y - y') = (25.3 – 45.671) = -20.371. If we simply sum these prediction errors we will always get zero because the negative errors and positive errors will always cancel. We get around this in the familiar way by squaring the result [$d^2 = (y\text{-}y')^{2} =$ -20.371*-20.371 = 414.995]. You calculate the standard error of estimate by summing these squared difference scores, dividing by n-1, then undoing the squaring operation by taking a square root. I've done the first two rows to get you started. Fill in the rest of the table (refer back to the figure on the next page to remind yourself of what you're doing), then: (1) sum the d^2 column, (2) divide by n-1, (3) take the square root. See last page for solution.

d = (y-y')
d^2 = $(y\text{-}y')^2$

	x	*y*	*y'*	*d*	*d^2*
1	11.500	24.200	3.460	20.740	430.144
2	50.000	25.300	44.048	-18.748	351.472
3	65.400	67.400	60.283		
4	88.500	95.800	84.635		
5	73.100	89.500	68.400		
6	96.200	95.800	92.753		
7	61.500	32.600	56.171		
8	57.700	74.700	52.165		
9	19.200	22.100	11.578		
10	23.100	22.100	15.689		
11	76.900	91.600	72.406		
12	92.300	71.600	88.641		
13	34.600	27.400	27.813		
14	53.800	27.400	48.054		
15	61.500	42.100	56.171		
16	96.200	82.100	92.753		
17	100.000	100.000	96.759		
18	46.200	40.000	40.042		
19	69.200	76.800	64.289		
20	42.300	34.700	35.930		
21	26.900	2.100	19.695		
22	23.100	0.000	15.689		
23	10.000	4.000	1.879		



Test-re-test reliability of breathiness ratings measured by comparing the ratings of two independent listeners.



This is the same figure as the previous page, but with prediction errors (y-y') drawn as lines. The standard error of estimate is the “average” length of these prediction-error lines. I’ve put the word *error* in quotes because we’ve calculated the average in round-about way, by squaring each line length, averaging the *squared* lengths (but dividing by *n-1* instead of *n*), then undoing the squaring operation with a final square root.

Answer

	x	y	y’	d	d^2
1	11.500	24.200	3.460	20.740	430.144
2	50.000	25.300	44.048	-18.748	351.472
3	65.400	67.400	60.283	7.117	50.657
4	88.500	95.800	84.635	11.165	124.655
5	73.100	89.500	68.400	21.100	445.206
6	96.200	95.800	92.753	3.047	9.287
7	61.500	32.600	56.171	-23.571	555.598
8	57.700	74.700	52.165	22.535	507.822
9	19.200	22.100	11.578	10.522	110.721
10	23.100	22.100	15.689	6.411	41.100
11	76.900	91.600	72.406	19.194	368.404
12	92.300	71.600	88.641	-17.041	290.400
13	34.600	27.400	27.813	-0.413	0.170
14	53.800	27.400	48.054	-20.654	426.573
15	61.500	42.100	56.171	-14.071	197.997
16	96.200	82.100	92.753	-10.653	113.478
17	100.000	100.000	96.759	3.241	10.506
18	46.200	40.000	40.042	-0.042	0.002
19	69.200	76.800	64.289	12.511	156.534
20	42.300	34.700	35.930	-1.230	1.513
21	26.900	2.100	19.695	-17.595	309.587
22	23.100	0.000	15.689	-15.689	246.146
23	10.000	4.000	1.879	2.121	4.500

Sum of the squared differences = 4752.472
Mean squared difference = 4752.472/(n-1) = 4752.472/(22) = 216.021
Sqrt (216.021) = 14.677

$S_{y.x}$ = 14.677