Standard deviation: ungrouped data

$$s = \sqrt{\frac{\sum (Y - \bar{Y})^2}{n}}$$

Check precedence order for calculation!

Standard deviation: grouped data

$$s = \sqrt{\frac{\sum f(Y - \overline{Y})^2}{n}}$$

Check precedence order for calculation!

Standard deviation example: scores on a midterm

interval	midpt.	f	fY	$Y - \overline{Y}$	$(Y - \overline{Y})^2$	$f(Y - \overline{Y})^2$
1-5	3	x 0	= 0	-18.9	357.21	0
6-10	8	x 1	= 8	-13.9	193.21	193.21
11-15	13	x 6	= 78	-8.9	79.21	475.26
16-20	18	x 19	= 342	-3.9	15.21	288.99
21-25	23	x 33	= 759	1.1	1.21	39.93
26-30	28	x 17	= 476	6.1	37.21	632.57
		76	1663			1629.96

Standard deviation: calculating formula

$$s = \sqrt{\frac{\sum fY^2}{n} - \left(\sum fY / n\right)^2}$$

Mean of the squares

Square of the means

Standard deviations: calculating formula

Y	Y^2	f	fY^2	fY
3	9	0	0	0
8	64	1	64	8
13	169	6	1014	78
18	324	19	6156	342
23	529	33	17,457	759
28	784	17	13,328	476
		76	38,019	1663

Standard deviation: calculating formula

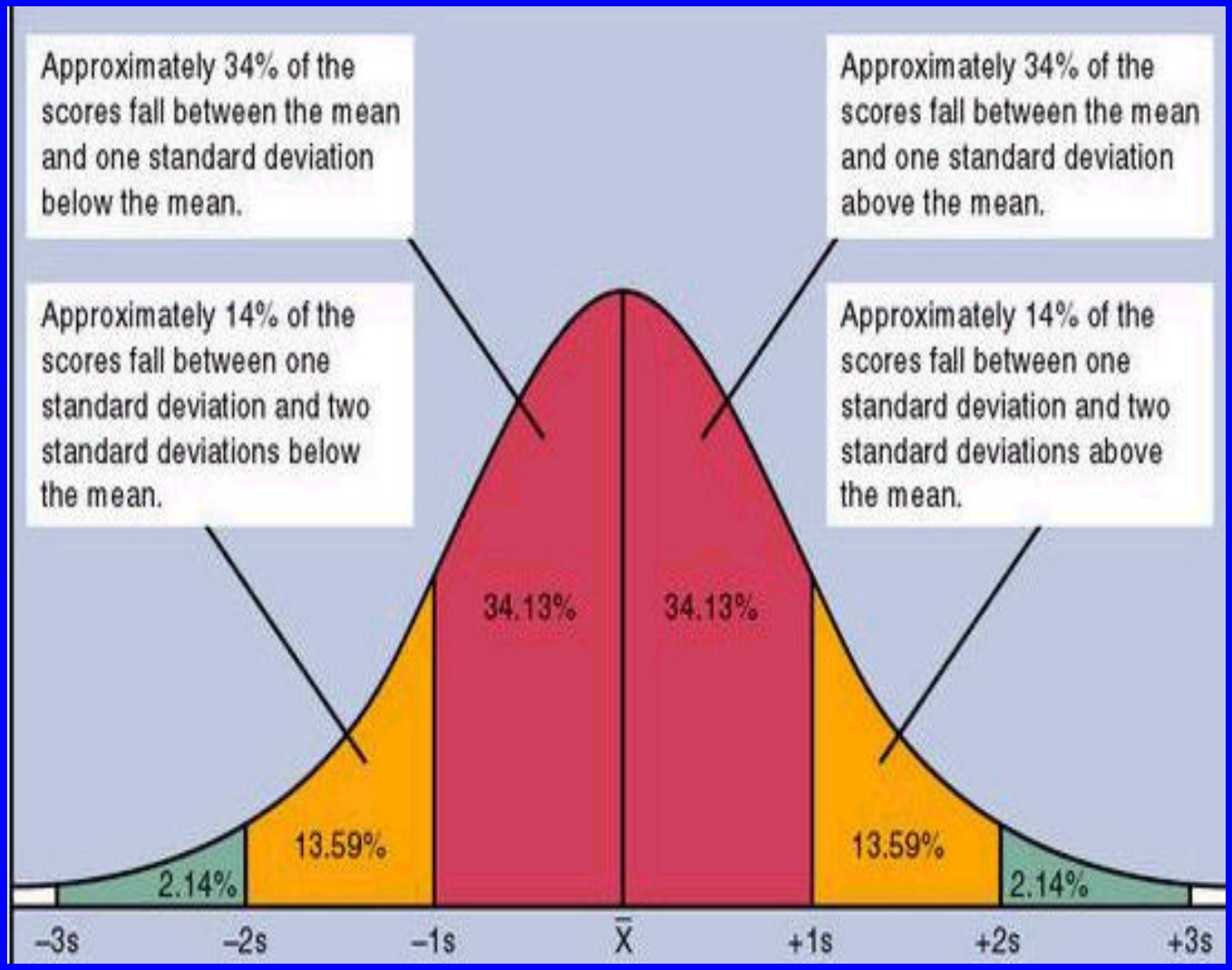
$$s = \sqrt{(38{,}019/76) - (1663/76)^2}$$

$$s = \sqrt{500.25 - (21.88)^2}$$

$$s = \sqrt{21.5156}$$

$$s = 4.6$$

Standard deviation



8.1 12.7 17.3 $\bar{Y}=219$ 26.5 30 30