

Variance (S²) =
$$\frac{\sum (x_i - \overline{x})^2}{n-1}$$
 S = $\sqrt{S^2}$ = $\sqrt{\frac{\sum (x_i - \overline{x})^2}{n-1}}$
Question: The following data represent the total fat for burgers items from a sample of fast-food chains. Find the variance, and standard deviation.
7, 9, 16, 18, 15, 16, 22, 25 27, 33, 39

Sample Variance (S²) Method 1:

Step 1 Enter all data in Excel software program

Step 2: Find the mean by using the AVERAGE function: =AVERAGE(B2:B12)



The average (mean) goes to any empty cell, say B13.

Step 3: Subtract the mean (average) from each number in the sample:

- move cursor to column C2
- Type: =**B2-**\$**B**\$13 (mean value is in col **B**13, we will lock as a constant value)
- Click Enter. (You shall see the value of x-mean = -13.64 in column C2)
- move cursor to the corner of column C2 and drag until col C12





The differences go to column C, beginning in C2.

Step 4: Square each difference and put the results to column **D**, beginning in **D**2:

- Move cursor to column **D2**
- Type: =C2^2
- Click Enter. (You shall see the value of $(x-mean)^2 = 185.9504$ in column D2)
- move cursor to the corner of column D2 and drag until col D12

				·=· · · · · · · · · · · · · · · · · · ·		C	lipboard 😼	Fe	ont	Alig	Inment
D2		· · · · × · ·	$f_x = C2$!^2		D1	L3 ·	· I × v	f _x		
	A	В	С	D	E		Δ	В	C	D	F
1	Burgers	Fat	x - mean	(x-mean)^2		1	Burgers	Fat	x - mean	(x-mean)^2	
2	A	7	-13.64	185.9504		2	A	7	-13.64	185.9504	
3	В	9	-11.64			3	В	9	-11.64	135.4050	
4	С	16	-4.64			4	С	16	-4.64	21.4959	
5	D	18	-2.64			5	D	18	-2.64	6.9504	
6	E	15	-5.64			6	E	15	-5.64	31.7686	
7	F	16	-4.64			7	F	16	-4.64	21.4959	
8	G	22	1.36			8	G	22	1.36	1.8595	
9	н	25	4.36			9	н	25	4.36	19.0413	
10	1	27	6.36			10	1 I	27	6.36	40.4959	
11	J	33	12.36			11	J	33	12.36	152.8595	
12	F	39	18.36			12	F	39	18.36	337.2231	
13	mean	20.64				13	mean	20.64			
14						14					
14						15					

- **Step 5:** Add up the squared differences and divide the result by (n 1) or the number of items in the sample minus 1:
 - Move cursor to column **D15**
 - Type: =SUM(D2:D12)/(COUNT(B2:B12) 1)
 - or =SUM(D2:D12)/(12-1)
 - Click Enter. (You shall see the value of variance 95.5455 in column D15)

CI	ipboard E	rd 🖬 Font			Alignment
B2		- : ;	$\times \checkmark f_x$	=SUM(D2:D12)/(COUN	IT(B2:B12)-1
	А	В	С	D	E
1	Burgers	Fat	x-mean		
2	Α	7	-13.64	185.95]
3	В	9	-11.64	135.40	
4	С	16	-4.64	21.50	
5	D	18	-2.64	6.95	
6	E	15	-5.64	31.77	
7	F	16	-4.64	21.50	
8	G	22	1.36	1.86	
9	н	25	4.36	19.04	
10	1	27	6.36	40.50	
11	J	33	12.36	152.86	
12	F	39	18.36	337.22	
13	mean	20.64			
14			SUM	954.55	
15			VAR	=SUM(D2:D12)/(COUN	- T(B2:B12)-1)
16					
17					

Clipbo	bard IS	1	Font	د ا	Alignment
C17		+ ± 2	$\langle - \sqrt{-f_x} \rangle$		
	А	В	С	D	E
1 Bu	rgers	Fat	x-mean		
2	Α	7	-13.64	185.95	
3	В	9	-11.64	135.40	
4	С	16	-4.64	21.50	
5	D	18	-2.64	6.95	
6	E	15	-5.64	31.77	
7	F	16	-4.64	21.50	
8	G	22	1.36	1.86	
9	н	25	4.36	19.04	
10	1	27	6.36	40.50	
11	J	33	12.36	152.86	
12	F	39	18.36	337.22	
13	mean	20.64			
14			SUM	954.55	
15			Sample Var	95.45454545	
16					
17					
18					

Cli	ipboard f	2	Font	5		Alignment
B2		* : ×	$\checkmark f_x$	=VAR.S(B2	:B12)	
	А	В	С		D	
1	Burgers	Fat	x-mean	(x	-mean)^2	
2	Α	7	-13	3.64	185.95	i
3	В	9	-11	L.64	135.40)
4	С	16	-4	1.64	21.50)
5	D	18	-2	2.64	6.95	i
6	E	15	-5	5.64	31.77	
7	F	16	-4	1.64	21.50)
8	G	22	1	L.36	1.86	i
9	н	25	4	1.36	19.04	l.
10	1	27	6	5.36	40.50)
11	J	33	12	2.36	152.86	i
12	F	39	18	3.36	337.22	
13	mean	20.64				
14			SUM		954.55	
15			Sample Var		95.45454545	
16						
17		Method 2	Sample Var	=VAR.S	(B2:B12)	
18						
19						

Method 2:	Move cursor to D17	or any empty space and Type:	=VAR.S(B2:B12)
-----------	--------------------	------------------------------	----------------

cl	ipboard	r <u>s</u>	Font	<u>د</u> ا		Alignmer
B1	7	• I ×	$\checkmark f_x$	Vethod 2		
	А	В	с		D	
1	Burgers	Fat	x-mean	(×	-mean)^2	
2	Α	7	-13.6	4	185.95	5
3	В	9	-11.6	4	135.40)
4	С	16	-4.6	4	21.50)
5	D	18	-2.6	4	6.95	i
6	E	15	-5.6	4	31.77	1
7	F	16	-4.6	4	21.50)
8	G	22	1.3	6	1.86	5
9	н	25	4.3	6	19.04	Ļ
10	1	27	6.3	6	40.50)
11	J	33	12.3	6	152.86	5
12	F	39	18.3	6	337.22	2
13	mean	20.64				
14			SUM		954.55	;
15			Sample Var		95.45454545	5
16						
17		Method 2	Sample Var		95.45454545	;
18						
19						

b) Find the value of sample standard deviation:

Find the value of **sample standard deviation**:

- Move cursor to column **D18**
- Type: **=SQRT(D17**)
- Click Enter.

You shall see the value of sample standard deviation 9.770084209 in column D18

C	lipboard	E .	Font	I2	Alignment			
D1	18	• I ×	√ <i>f</i> x =S	QRT(D17)				
	A	В	с	D	E			
1	Burgers	Fat	x-mean	(x-mean)^2				
2	A	7	-13.64	185.95				
3	В	9	-11.64	135.40				
4	С	16	-4.64	21.50				
5	D	18	-2.64	6.95				
6	E	15	-5.64	31.77				
7	F	16	-4.64	21.50				
8	G	22	1.36	1.86				
9	н	25	4.36	19.04				
10	- I	27	6.36	40.50				
11	J	33	12.36	152.86				
12	F	39	18.36	337.22				
13	mean	20.64						
14			SUM	954.55				
15			Sample Var	95.45454545				
16								
17		Method 2	Sample Var	95.45454545				
18			Standard Dev	9.770084209				
19								
20								

Sample Variance of fast-food chains = 95.4545

Sample standard deviation = 9.77