Solutions 4.

(1) range = 2.7 − 1.1 = 1.6

From calculator :

population SD	$\sigma \simeq 0.51$
population variance	$\sigma^2 \simeq 0.26$
sample SD	$s \simeq 0.56$
sample variance	$s^2 = 0.316$

(2) range = 162 − 108 = 54

population SD	$\sigma \simeq 17.53$
population variance	$\sigma^2 \simeq 307.34$
sample SD	$s \simeq 17.83$
sample variance	$s^2 \simeq 317.94$

(3) Use population SD σ unless "sample" is mentioned or implied.

Class A $\sigma \simeq 5.96$ ← smaller

Class B $\sigma \simeq 8.16$

Class A's scores are more tightly clustered.

(4) New mean is $12 \times 1.6 = 19.2$

New SD is $1.4 \times 1.6 = 2.24$

(5) New mean is $12 + 8 = 20$

New SD is 1.4

Adding 8 to each measurement does not change the SD.

(6) Originally $\sigma = 2.7$

Multiply each measurement by $\frac{9}{5}$: now $\sigma = 2.7\left(\frac{9}{5}\right)$

$\sigma = 4.86$

Add 32 to each measurement : σ does not change

$\sigma = 4.86$

Population variance $\sigma^2 = 23.6196$

(7)

X	$X-\mu$	$(X-\mu)^2$
3	-6	36
8	-1	1
9	0	0
11	2	4
14	5	25

$\mu = 9$

$\sigma^2 = \frac{36+1+0+4+25}{5}$ ← n

$= \frac{66}{5}$

(8)

X	$X-\bar{x}$	$(X-\bar{x})^2$
9	-2	4
10	-1	1
10	-1	1
11	0	0
15	4	16

$\bar{x} = 11$

$s^2 = \frac{4+1+1+0+16}{4}$ ← $n-1$

$= \frac{22}{4}$

or $\frac{11}{2}$

(9) Ordered:

1.1, 1.3, 1.3, 1.4, 1.5, 1.5, 1.6, 1.7, 1.8, 1.8, 2.1, 2.3

From calculator: $\mu \approx 1.617$ $\sigma \approx 0.331$

$\mu - \sigma \approx 1.286$ $\mu + \sigma \approx 1.948$

$\frac{9}{12}$ measurements lie in the interval

$1.286 \leq X \leq 1.948$

75% of measurements lie in the interval.

(10)

X	$X-\mu$	$(X-\mu)^2$
		0

these are always ≥ 0

If $\sigma^2 = 0$ then $(X-\mu)^2$ are all 0

$\Rightarrow$ each X equals μ

$\Rightarrow$ All measurements are equal.