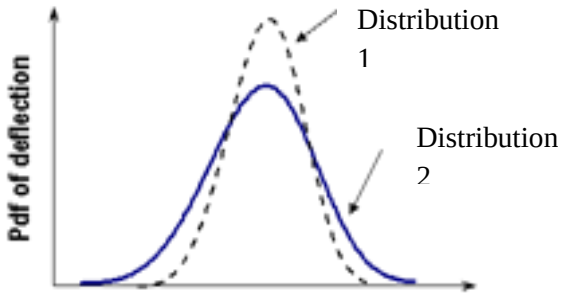
Conceptual Questions

Please put your answers in the following table.

1	2	3	4	5	6	7	8

1. Which statement is not true about a standard deviation?
   A) It is always non-negative.
   B) It represents the dispersion around the mean value.
   C) It can be negative.
   D) The larger is the standard deviation, the higher is uncertainty.

2. Two normal distributions are shown below. Which statement is true?



   A) $\sigma_1 > \sigma_2$
   B) $\sigma_1 < \sigma_2$
   C) $\sigma_1 = \sigma_2$
   D) Cannot determine

3. The actual values of a force (N) acting on a rigid body are given below.

105.4
118.3
77.4
108.6
103.2
86.9
95.7
103.4
135.8
127.7
86.5
130.3
107.3
99.4
107.1

The average of the force is

A) 100.0 N
B) 210.0 N
C) 106.2 N
D) 25.4 N

4. For problem 3, the standard deviation of the force is

A) 10.1 N
B) 0.0 N
C) 103.2 N
D) 16.56 N

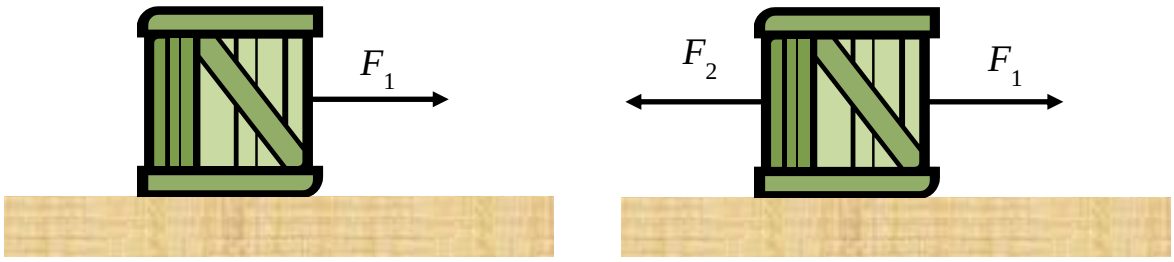
5. The mass of a particle is $m = 10$ kg. The particle is subjected to a force that is normally distributed. Knowing $F \sim N(\mu_F, \sigma_F^2)$ where $\mu_F = 10.0$ N and $\sigma_F = 1.0$ N, determine the mean and standard deviation of the acceleration of the particle.

A) $\mu_a = 1.0 \text{ m/s}^2$, $\sigma_a = 0.1 \text{ m/s}^2$
B) $\mu_a = 1.0 \text{ m/s}^2$, $\sigma_a = 1.0 \text{ m/s}^2$
C) $\mu_a = 1.0 \text{ m/s}^2$, $\sigma_a = 0 \text{ m/s}^2$
D) $\mu_a = 1.0 \text{ m/s}^2$, $\sigma_a = 0.01 \text{ m/s}^2$

6. For problem 5, what is the probability that the force is less than 12 N or $\Pr\{F < 12 \text{ N}\}$?

A) 0
B) 50%
C) 97.72%
D) 86.5%

7. A crate is subject to (Case 1) a random force $F_1 \sim (10,1^2)$ N, and (Case 2): two independent random forces $F_1 \sim (10,1^2)$ N and $F_2 \sim (10,1^2)$ N. Neglect friction. Which of the following statements is not true?



Case 1

Case 2

A) The average acceleration of the crate in Case 1 is 1 m/s.
B) The average acceleration of the crate in Case 1 is less than that in Case 2.
C) The average acceleration of the crate in Case 2 is non-zero.

D) The average acceleration of the crate in Case 2 is zero.

8. For the above problem, which of the following statements is not true?
   A) The standard deviation of the acceleration in Case 1 is less than that in Case 2.
   B) The standard deviation of the acceleration in Case 2 is zero.
   C) The standard deviation of the acceleration in Case 1 is greater than zero.
   D) The standard deviation of the acceleration in Case 2 is greater than zero.