1. **Problem**
   Let random variable W have mean $\mu_w = 11$ and standard deviation $\sigma_w = 2$. Let random variable X represent the **sum** of $n = 169$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 1884.74)$.

   (d) Using normal approximation, determine $P(X > 1878.76)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 11.96)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 4.42)$.

2. **Problem**
   Let random variable W have mean $\mu_w = 22$ and standard deviation $\sigma_w = 3$. Let random variable X represent the **sum** of $n = 81$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 1773.63)$.

   (d) Using normal approximation, determine $P(X > 1762.02)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 29.43)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 33.21)$.

3. **Problem**
Let random variable W have mean $\mu_w = 39$ and standard deviation $\sigma_w = 9$. Let random variable X represent the **average** of $n = 196$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 38.93)$.

   (d) Using normal approximation, determine $P(X > 39.35)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 0.2636)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 0.18)$.

4. **Problem**
Let random variable W have mean $\mu_w = 45$ and standard deviation $\sigma_w = 14$. Let random variable X represent the **average** of $n = 100$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 46.3)$.

   (d) Using normal approximation, determine $P(X > 45.71)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 2.282)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 1.246)$.

5. **Problem**
Let random variable W have mean $\mu_w = 11$ and standard deviation $\sigma_w = 2$. Let random variable X represent the **sum** of $n = 225$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 2452.8)$.

   (d) Using normal approximation, determine $P(X > 2521.8)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 20.4)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 27)$.

6. **Problem**
Let random variable W have mean $\mu_w = 58$ and standard deviation $\sigma_w = 19$. Let random variable X represent the **average** of $n = 225$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 59.79)$.

   (d) Using normal approximation, determine $P(X > 58.09)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 0.5573)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 0.722)$.

7. **Problem**
Let random variable W have mean $\mu_w = 9$ and standard deviation $\sigma_w = 2$. Let random variable X represent the **average** of $n = 36$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 8.56)$.

   (d) Using normal approximation, determine $P(X > 9.07)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 0.2467)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 0.2167)$.

8. **Problem**
Let random variable W have mean $\mu_w = 57$ and standard deviation $\sigma_w = 17$. Let random variable X represent the **sum** of $n = 169$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 9535.76)$.

   (d) Using normal approximation, determine $P(X > 9593.22)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 112.71)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 316.03)$.

9. **Problem**
Let random variable W have mean $\mu_w = 57$ and standard deviation $\sigma_w = 13$. Let random variable X represent the **average** of $n = 49$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 55.83)$.

   (d) Using normal approximation, determine $P(X > 56.05)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 1.0214)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 0.7243)$.

10. **Problem**
Let random variable W have mean $\mu_w = 40$ and standard deviation $\sigma_w = 2$. Let random variable X represent the **sum** of $n = 81$ instances of W.

   (a) Determine the expected value of X. $\mu_x = ?$

   (b) Determine the standard deviation of X. $\sigma_x = ?$

   (c) Using normal approximation, determine $P(X < 3245.04)$.

   (d) Using normal approximation, determine $P(X > 3236.4)$.

   (e) Using normal approximation, determine $P(|X - \mu_x| < 13.86)$.

   (f) Using normal approximation, determine $P(|X - \mu_x| > 12.96)$.

11. **Problem**
Let random variable W have mean $\mu_w = 59$ and standard deviation $\sigma_w = 17$. Let random variable X represent the **average** of $n = 64$ instances of W.

(a) Determine the expected value of X. $\mu_x = ?$

(b) Determine the standard deviation of X. $\sigma_x = ?$

(c) Using normal approximation, determine $P(X < 56.2)$.

(d) Using normal approximation, determine $P(X > 58.72)$.

(e) Using normal approximation, determine $P(|X - \mu_x| < 0.17)$.

(f) Using normal approximation, determine $P(|X - \mu_x| > 0.9775)$.

12. **Problem**
Let random variable W have mean $\mu_w = 27$ and standard deviation $\sigma_w = 5$. Let random variable X represent the **sum** of $n = 144$ instances of W.

(a) Determine the expected value of X. $\mu_x = ?$

(b) Determine the standard deviation of X. $\sigma_x = ?$

(c) Using normal approximation, determine $P(X < 3886.2)$.

(d) Using normal approximation, determine $P(X > 3895.2)$.

(e) Using normal approximation, determine $P(|X - \mu_x| < 54)$.

(f) Using normal approximation, determine $P(|X - \mu_x| > 95.4)$.

1. (a) 1859
   (b) 26
   (c) 0.8389
   (d) 0.2236
   (e) 0.3545
   (f) 0.865
2. (a) 1782
   (b) 27
   (c) 0.3783
   (d) 0.7704
   (e) 0.7243
   (f) 0.2187
3. (a) 39
   (b) 0.6429
   (c) 0.4562
   (d) 0.5438
   (e) 0.3182
   (f) 0.7795
4. (a) 45
   (b) 1.4
   (c) 0.8238
   (d) 0.1762
   (e) 0.8969
   (f) 0.3735
5. (a) 2475
   (b) 30
   (c) 0.2296
   (d) 0.0594
   (e) 0.5035
   (f) 0.3681
6. (a) 58
   (b) 1.2667
   (c) 0.9207
   (d) 0.0793
   (e) 0.3401
   (f) 0.5687
7. (a) 9
   (b) 0.3333
   (c) 0.0951
   (d) 0.9049
   (e) 0.5407
   (f) 0.5157
8. (a) 9633
   (b) 221
   (c) 0.33
   (d) 0.5714
   (e) 0.3899
   (f) 0.1527
9. (a) 57
   (b) 1.8571
   (c) 0.2643
   (d) 0.7357
   (e) 0.4177
   (f) 0.6965
10. (a) 3240
    (b) 18
    (c) 0.6103
    (d) 0.5793
    (e) 0.5587
    (f) 0.4715
11. (a) 59
    (b) 2.125
    (c) 0.0934
    (d) 0.9066
    (e) 0.0638
    (f) 0.6455
12. (a) 3888
    (b) 60
    (c) 0.488
    (d) 0.4522
    (e) 0.6319
    (f) 0.1118