



Unit 6: Geometry Lesson 6.3

Coach's Corner – IV

1. A set of data is normally distributed with $\mu = 2.2$ and $\sigma = 4.5$. Determine the z -score for the following data values.

a. -9.1

$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{-9.1 - 2.2}{4.5}$$

$$z = -2.51$$

b. 2.7

$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{2.7 - 2.2}{4.5}$$

$$z = 0.11$$

2. A set of data is normally distributed with $\mu = 549$ and $\sigma = 21$. Determine the data value corresponding to the following z -scores.

a. $z = 2.20$

$$z = \frac{x - \mu}{\sigma}$$

$$2.20 = \frac{x - 549}{21}$$

$$46.2 = x - 549$$

$$595.2 = x$$

b. $z = -3.12$

$$z = \frac{x - \mu}{\sigma}$$

$$-3.12 = \frac{x - 549}{21}$$

$$-65.52 = x - 549$$

$$483.5 = x$$

3. Some species of cuckoo birds will lay their eggs in other birds' nests so their young are raised by another species.

A study of egg lengths showed that individual cuckoos prefer certain species and their egg lengths are comparable. The table below shows cuckoo egg lengths measured from various other birds' nests. Each set of data is fairly normally distributed.



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Lengths of Cuckoo Eggs Found in Other Birds' Nests (mm)						
Meadow Pipit		Tree Pipit	Hedge Sparrow	Robin	Pied Wagtail	Wren
19.65	22.25	21.05	20.85	21.05	21.05	19.85
20.05	22.25	21.85	21.65	21.85	21.85	20.05
20.65	22.25	22.05	22.05	22.05	21.85	20.25
20.85	22.25	22.45	22.85	22.05	21.85	20.85
21.65	22.25	22.65	23.05	22.05	22.05	20.85
21.65	22.45	23.25	23.05	22.25	22.45	20.85
21.65	22.45	23.25	23.05	22.45	22.65	21.05
21.85	22.45	23.25	23.05	22.45	23.05	21.05
21.85	22.65	23.45	23.45	22.65	23.05	21.05
21.85	22.65	23.45	23.85	23.05	23.25	21.25
22.05	22.85	23.65	23.85	23.05	23.45	21.45
22.05	22.85	23.85	23.85	23.05	24.05	22.05
22.05	22.85	24.05	24.05	23.05	24.05	22.05
22.05	22.85	24.05	25.05	23.05	24.05	22.05
22.05	23.05	24.05		23.25	24.85	22.25
22.05	23.25			23.85		
22.05	23.25					
22.05	23.45					
22.05	23.65					
22.05	23.85					
22.25	24.25					
22.25	24.45					
22.25						

Source: <http://lib.stat.cmu.edu/DASL/Datafiles/cuckoodat.html>

- a. Determine the mean and standard deviation for each set of eggs.

	Meadow Pipit	Tree Pipit	Hedge Sparrow	Robin	Pied Wagtail	Wren
Mean	22.30	23.09	23.12	22.58	22.90	21.13
Standard Deviation	0.91	0.87	1.03	0.66	1.03	0.72

- b. Determine the z-score for an egg of 22.45 mm for each set of eggs.

$$z_M = \frac{x_M - \mu_M}{\sigma_M}$$

$$z_M = \frac{22.45 - 22.30}{0.91}$$

$$z_M = 0.16$$

$$z_T = \frac{x_T - \mu_T}{\sigma_T}$$

$$z_T = \frac{22.45 - 23.09}{0.87}$$

$$z_T = -0.74$$

$$z_H = \frac{x_H - \mu_H}{\sigma_H}$$

$$z_H = \frac{22.45 - 23.12}{1.03}$$

$$z_H = -0.65$$

$$z_R = \frac{x_R - \mu_R}{\sigma_R}$$

$$z_R = \frac{22.45 - 22.58}{0.66}$$

$$z_R = -0.20$$

$$z_P = \frac{x_P - \mu_P}{\sigma_P}$$

$$z_P = \frac{22.45 - 22.90}{1.03}$$

$$z_P = -0.44$$

$$z_W = \frac{x_W - \mu_W}{\sigma_W}$$

$$z_W = \frac{22.45 - 21.13}{0.72}$$

$$z_W = 1.83$$

- c. List the birds in order from most likely to have a 22.45 mm egg to least likely to have a 22.45 mm egg. Explain your reasoning.

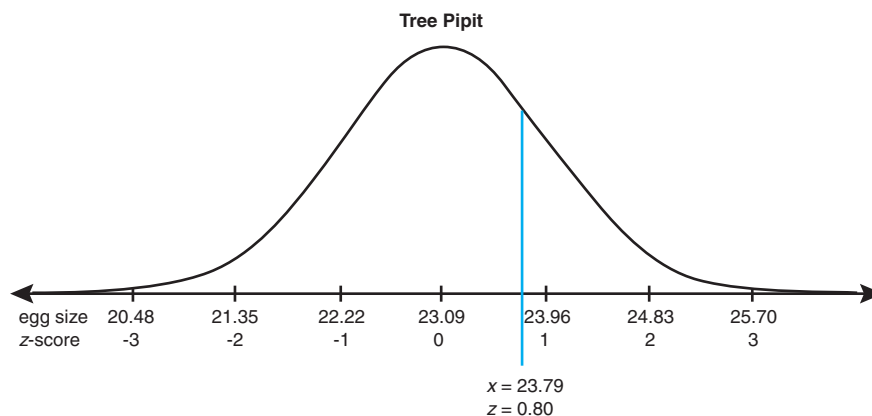
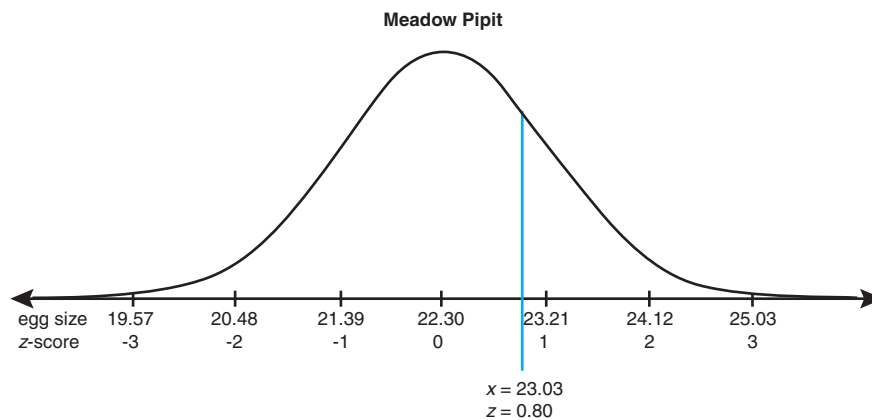
Meadow pipit, robin, pied wagtail, hedge sparrow, tree pipit, and then wren.

A z-score close to zero means the value is very close to the mean. The data is reasonably normally distributed, so most data will cluster around the mean and thus the closer to the mean, the more likely the value.

- d. Determine the egg length that corresponds to a z-score of 0.80 for the two pipits. Explain the difference.

$$\begin{aligned}
 z_M &= \frac{x_M - \mu_M}{\sigma_M} & z_T &= \frac{x_T - \mu_T}{\sigma_T} \\
 0.80 &= \frac{x_M - 22.30}{0.91} & 0.80 &= \frac{x_T - 23.09}{0.87} \\
 0.91 \cdot 0.80 &= \frac{x_M - 22.30}{0.91} \cdot 0.91 & 0.87 \cdot 0.80 &= \frac{x_T - 23.09}{0.87} \cdot 0.87 \\
 0.728 &= x_M - 22.30 & 0.696 &= x_T - 23.09 \\
 23.03 &= x_M & 23.79 &= x_T
 \end{aligned}$$

A z-score of 0.80 represents a data value located 0.80 standard deviations above the mean. The standard deviations for the two birds are similar, but the mean for the tree pipit is higher, resulting in a higher x-value at $z = 0.80$.



Please return to *Unit 6: Statistics Lesson 6.3* to continue your training.