Problem Solving

7-6 The Natural Base, e

In 2004 there were 213 birds at a wildlife refuge in Texas. This number exceeded the 2003 record by 19. If the population of birds can be modeled using the exponential growth function $P_t = P_0e^{kt}$, the population, P_t, at time t can be found, where P_0 is the initial population and k is the growth factor. Predict the population of birds over the next few years.

1. What was the size of the population of birds in 2003? _____

2. Use the population figures for 2003 and 2004 to find the growth factor, k.

   Solution:

   $$P_t = P_0e^{kt}$$
   $$213 = 194e^{k \times 1}$$
   $$\frac{213}{194} = e^k$$
   $$1.097938 = e^k$$
   $$\ln 1.097938 = \ln e^k$$
   $$0.0934 = k$$

3. Complete the table to predict the population of whooping cranes through 2010.

   Solution:

Year	2006	2007	2008	2009	2010
t	3	4			
Population, P_t	257				

   $$P_t = P_0e^{kt}$$
   $$P_3 = 194e^{0.0934 \times 3}$$
   $$P_3 = 194e^{0.2802}$$
   $$P_3 = 257$$

Choose the letter for the best answer.

4. When will the population of birds exceed 1000. Using the 2003 population as P_0, which year is the best prediction?

   A 2017

   B 2019

   C 2021

5. How long will it take for an investment in an account paying 6% compounded continuously to double?

   F 10.2 years

   G 10.8 years

   H 11.6 years

LESSON **Problem Solving**
7-6 *The Natural Base, e*

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   $$\frac{213}{194} = e^k$$
   $$1.097938 = e^k$$
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   $$0.0934 = k$$

3. Complete the table to predict the population of whooping cranes through 2010.

   Solution:

Year	2006	2007	2008	2009	2010
t	3	4	**5**	**6**	**7**
Population, P_t	257	**282**	**309**	**340**	**373**

   $$P_t = P_0e^{kt}$$
   $$P_3 = 194e^{0.0934 \times 3}$$
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