

CONTINUOUS RANDOM VARIABLES: PRACTICE 2*

Susan Dean
Barbara Illowsky, Ph.D.

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Abstract

In this module the student will explore the properties of data with an exponential distribution.

1 Student Learning Outcomes

- The student will explore the properties of data with a exponential distribution.

2 Given

Carbon-14 is a radioactive element with a half-life of about 5730 years. Carbon-14 is said to decay exponentially. The decay rate is 0.000121 . We start with 1 gram of carbon-14. We are interested in the time (years) it takes to decay carbon-14.

3 Describe the Data

Exercise 1

What is being measured here?

Exercise 2

Are the data discrete or continuous?

(Solution on p. 4.)

Exercise 3

In words, define the Random Variable X .

(Solution on p. 4.)

Exercise 4

What is the decay rate (m)?

(Solution on p. 4.)

Exercise 5

The distribution for X is:

(Solution on p. 4.)

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4 Probability

Exercise 6

(Solution on p. 4.)

Find the amount (percent of 1 gram) of carbon-14 lasting less than 5730 years. This means, find $P(X < 5730)$.

- a. Sketch the graph. Shade the area of interest.



Figure 1

- b. Find the probability. $P(X < 5730) =$

Exercise 7

(Solution on p. 4.)

Find the percentage of carbon-14 lasting longer than 10,000 years.

- a. Sketch the graph. Shade the area of interest.



Figure 2

- b. Find the probability. $P(X > 10000) =$

Exercise 8

(Solution on p. 4.)

Thirty percent (30%) of carbon-14 will decay within how many years?

- a. Sketch the graph. Shade the area of interest.



Figure 3

- b. Find the value k such that $P(X < k) = 0.30$.

Solutions to Exercises in this Module

Solution to Exercise 2 (p. 1)

Continuous

Solution to Exercise 3 (p. 1)

X = Time (years) to decay carbon-14

Solution to Exercise 4 (p. 1)

$m = 0.000121$

Solution to Exercise 5 (p. 1)

$X \sim \text{Exp}(0.000121)$

Solution to Exercise 6 (p. 2)

b. $P(X < 5730) = 0.5001$

Solution to Exercise 7 (p. 2)

b. $P(X > 10000) = 0.2982$

Solution to Exercise 8 (p. 2)

b. $k = 2947.73$