

Topic Quiz #4 - Integrals

Spring 2007

Exponential Distribution: For each of the following problems, assume that your data is from an exponential distribution. For each problem, 1) Compute the average wait time parameter, 2) graph the proper probability density function with respect to time and label the point where $t = 0$, 3) express the probability being requested as an integral, 4) evaluate the integral using your calculator, and 5) provide a complete sentence that answers the question.

- If the help desk handles 6 calls per hour, what is the probability that you will have to wait less than 30 minutes for the next call?

1. 6 calls per hour \Rightarrow 10 minutes = λ

2. $p(w) = \frac{1}{10} e^{-w/10}$



3. $P(w < 30) = \int_0^{30} \frac{1}{10} e^{-w/10} dw = .9502$

5. The probability that you have to wait less than 30 minutes is 95.02%.

- If the help desk handles 15 calls per hour, what is the probability that you will have to wait more than 8 minutes to receive a call?

1. 15 calls per hour \Rightarrow $\lambda = 4$ minutes

2. $p(w) = \frac{1}{4} e^{-w/4}$



3. $P(w > 8) = 1 - P(w < 8) = 1 - \int_0^8 \frac{1}{4} e^{-w/4} dw$
 $= 1 - .8646 = .1354$

5. The probability that you have to wait more than 8 minutes is 13.54%.

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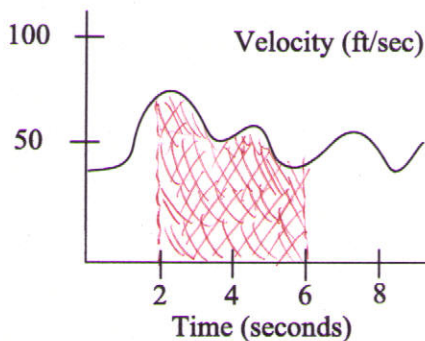


Figure A

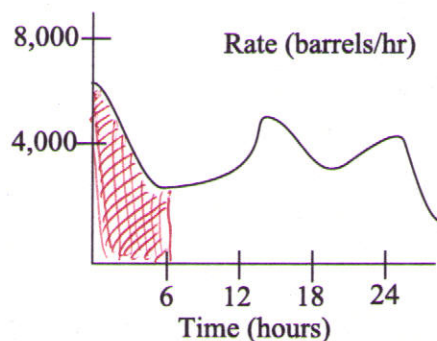


Figure B

- In Figure A, the graph represents the velocity of a bird. Shade in the region that would be shaded if you were able to use your calculator to compute the integral. Estimate the value of the integral and explain how you estimated this answer. Write a complete sentence that interprets the meaning of the integral.

$$\int_2^6 V(t) dt$$

During the time interval between $t=2$ and $t=6$, the bird seems to be averaging approximately 50 ft/sec. Therefore, the integral would be approximately 200 ft [50 ft/sec \cdot 4 sec].

The bird flew 200 ft during the time between $t=2$ and $t=6$ seconds.

- In Figure B, the graph represents the rate that an oil well operated on April 10th. Let t be the number of hours since midnight of April 10th. The well has produced 150,000 barrels of oil before April 10th. Shade in the region that would be shaded if you were able to use your calculator to compute the integral. Estimate the value of the integral and explain how you estimated this answer. With the information provided, write a complete sentence that interprets the meaning of the integral.

$$\int_0^6 R(t) dt$$

During the first 6 hours of April 10th, the oil well seems to be producing approximately 4,000 barrel/hr. So the integral would be approximately 24,000 barrels.

The oil well at 6:00 AM on April 10th will have produced 174,000 barrels of oil (24,000 + 150,000).