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## Linear Transformations of Random Variables - Quiz

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### Question 1

1/1 point (graded)

Suppose  $X$  is a continuous random variable. Let  $Y = aX + b$ , where  $a \neq 0$  and  $b$  are constants. Then which of the following is **not** true about the density of  $Y$ ?

☐ a.  $f_Y(y) = \frac{dF_Y(y)}{dy}$

☐ b.  $f_Y(y) = P(aX + b \leq y)$

☒ c.  $f_Y(y) = \frac{1}{a} f_x\left(\frac{y-b}{a}\right)$  ✓

☐ d.  $f(x) = \begin{cases} \frac{1}{a} f_x\left(\frac{y-b}{a}\right), & \text{if } a \geq 0 \\ \frac{-1}{a} f_x\left(\frac{y-b}{a}\right), & \text{if } a \leq 0 \end{cases}$

☐ e.  $f_Y(y) = \frac{1}{|a|} f_x\left(\frac{y-b}{a}\right)$

### Joint, Marginal, and Conditional Distributions

Finger Exercises due Oct 24, 2016  
at 05:00 IST

### Functions of Random Variables

Finger Exercises due Oct 24, 2016  
at 05:00 IST

### Module 4: Homework

Homework due Oct 17, 2016 at  
05:00 IST

- ▶ Module 5: Moments of a Random Variable, Applications to Auctions, & Intro to Regression
- ▶ Exit Survey

### Explanation

All of the statements above, except c, are mathematically true. However, recall that we needed to consider two cases, the distinction between the sign of  $a$ . To see this, recall that if  $a > 0$ ,

$$F_Y(y) = P(aX \leq y - b) = P(X \leq \frac{y-b}{a})$$

However, if  $a < 0$ ,

$$F_Y(y) = P(aX \leq y - b) = P(X > \frac{y-b}{a}) = 1 - P(X \leq \frac{y-b}{a})$$

Hence, the expression given in c is correct only if  $a > 0$ , but not in the case where  $a < 0$ .

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You have used 1 of 2 attempts

✓ Correct (1/1 point)

### Question 2

1/1 point (graded)

Suppose  $X$  is a continuous random variable, distributed uniformly over the unit interval  $[0, 1]$ . Let  $Y = 3X + 1$  What is the density of  $Y$ ,  $f_Y(y)$  evaluated at  $y = 4$ .

Please round your answer to the 2 decimal points. For example, if your answer is 0.567, please round to 0.57 and if it is 0.561, please round to 0.56.

✓ Answer: 0.33

0.33

### Explanation

From the formula Professor Ellison derived in lecture, we have that:

$$f_Y(y) = \frac{1}{|a|} f_x\left(\frac{y-b}{a}\right)$$

We know that the PDF of a uniform random variable distributed on an interval  $[c, d]$  is given by  $\frac{1}{d-c}$  for  $x \in [c, d]$ . Plugging in the numbers, we get:

$$f_Y(y) = \frac{1}{|a|} f_x\left(\frac{y-b}{a}\right) = \frac{1}{|3|} f_x\left(\frac{4-1}{3}\right) = \frac{1}{|3|} \frac{3}{3}$$

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You have used 1 of 2 attempts

✓ Correct (1/1 point)

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