You see $Y$, which is continuous. What's your best guess for $X$?

We did that Mon.

New: What's the best divide for $y$, to separate $x=-1$ from $x=1$?

Notes on 5.35 $P[A|B] P[B] = P[A \text{ and } B]$

Easier version of 5.40: sum of 2 independent normal r.v.

$X: \sim N(0,1) \quad Y: \sim N(0,1) \quad Z=X+Y$

We want $f_Z(z)$ convolve (works because they're independent)
\[ f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} \]

\[ f_Y(y) = \frac{1}{\sqrt{\pi \sqrt{3}}} e^{-\frac{y^2}{2 \cdot 3}} \]

\[ h(z) = \int f_X(z) f_Y(\sqrt{3}z) \, dz \]

\[ = \frac{1}{2\sqrt{3}} \int e^{-\frac{x^2 - (\frac{z}{2} - 3)^2}{2 \cdot 3}} \, dx \]

\[ = \frac{1}{2\sqrt{3}} \int e^{-\frac{(x - \frac{z}{2} + 3)^2}{2 \cdot 3}} \, dx \]

\[ = \frac{1}{2\sqrt{3}} \int e^{-\frac{1}{2} \left(x - \frac{z}{2} + 3\right)^2} \, dx \]

\[ = \frac{1}{2\sqrt{3}} e^{-\frac{(x - \frac{z}{2} + 3)^2}{2 \cdot 3}} \]

\[ = \frac{1}{\sqrt{2\pi \sqrt{3}}} e^{-\frac{(x - z/2 + 3)^2}{2 \cdot 3}} \]
The sum of two independent normal r.v. with $s=1$ is a normal r.v. with $s=\sqrt{2}$.

The book exercise assumes they're correlated.

If independent, then the variances add for normal.

If they're dependent, there's a range.

One extreme: $Y=-X$. What is $Z=X+Y$? $Z=0$

Other extreme $Y=X$. $Z=2X$ $s=2$

Non normal dist, e.g., $Y=X^2$. Not do that now.