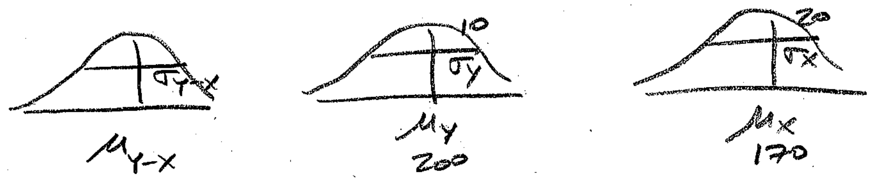
2008 b Q5

(a) $Y-X \quad = \quad Y \quad - \quad X$



algebra: $(Y-X) = Y - X$

means follow algebra: $\mu_{Y-X} = \mu_Y - \mu_X = 200 - 170 = \underline{30 \text{ minutes}}$

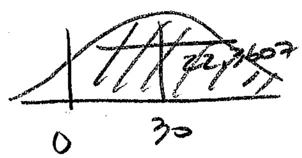
variances add: (even for minus) $\sigma^2_{Y-X} = \sigma^2_Y + \sigma^2_X = (10)^2 + (20)^2$

$\sigma_{Y-X} = \sqrt{10^2+20^2} = \underline{22.3607 \text{ minutes}}$

$\boxed{\text{The distribution of } Y-X \text{ is normal with mean} = 30 \text{ mins, SD} = 22.3607 \text{ mins}}$

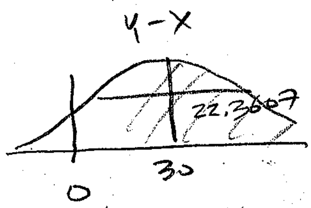
(b) X : time from Bullsnake to Copperhead
Y : time from Diamondback to Copperhead
they leave at the same time (noon) so train from Bullsnake will have to wait if it arrives before the Diamondback train; if X is less than Y or also if Y−X is <u>positive</u>. Using the distribution from part a)

Y−X



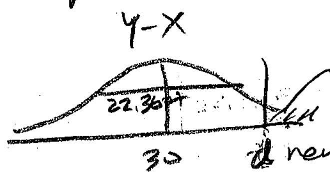
P(Bullsnake train waits) $= P(Y-X \geq 0) =$ normalcdf(0, 999, 30, 22.3607) (lower, upper, mean, SD)
$= \boxed{.9101}$

(c) using the same distribution from part 2:



as is, P(wait) = .9101

to lower this probability from .9101 to 0.01, the boundary must shift:



new boundary, which is the time delay, call this d

we find this using invNorm:

$$d = \text{invNorm}(\underbrace{.99}_{\text{area left}}, \underbrace{30}_{\text{mean}}, \underbrace{22.3607}_{\text{SD}}) = 82.0188 \text{ minutes}$$

since this distribution is for Y−X which is transit time for Diamondback − Bullsnake, adding 82.0188 minutes to Y−X is equivalent to delaying the Bullsnake train by this time.

we should delay the Bullsnake train by $\boxed{82.0188 \text{ minutes}}$.