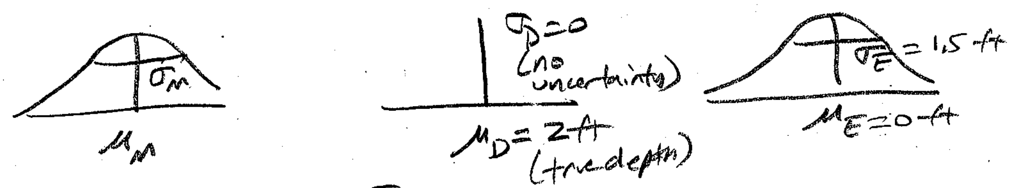
2006 Q3

(a) measurement M = actual depth D + error E



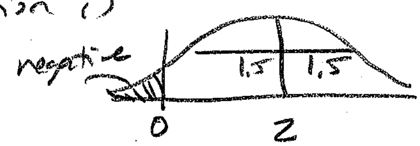
algebra: $M = D + E$

means follow the algebra: $\mu_M = \mu_D + \mu_E = 2 + 0 = 2$ ft

variances add: $\sigma_M^2 = \sigma_D^2 + \sigma_E^2 = 0^2 + (1.5)^2$

$\sigma_M = \sqrt{0^2 + 1.5^2} = 1.5$ ft

so M distribution is



now $P(M \le 0)$ = normalcdf(−999 lower, 0 upper, 2 mean, 1.5 SD) = **.0912**

(b) 3 independent depth measurements:
- multiple trials of the same thing
- trials independent
- probability of success on a single trial is constant $P(\text{negative}) = .0912 = p$
- find probability of # successes out of total = Binomial Model
- find probability of # successes out of total → number of negative measurements in 3

define random variable X for the number of negative measurements in 3

possibilities:

X	0	1	2	3

✓ if you use binompdf/cdf label values

P(at least 1 negative) = 1 − P(none are negative)

(3 ways to compute): all ok

1 − binompdf(3 trials, .0912 p, 0 x or # successes) = 1 − .7506 = **.2494**

1 − binomcdf(3, .0912, 0) = 1 − .7506 = **.2494**
(cumulative, but w/ 1 element) this is the same as pdf

$1 - {}_3C_0 (.0912)^0 (1 - .0912)^3$

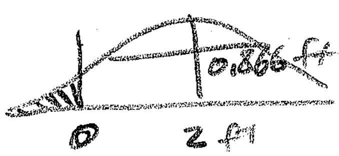
$1 - (1)(1)(.9088)^3 = 1 - .7506 =$ **.2494**

(c) Since we are finding the mean of 3 independent measurements this constitutes a sample, so we use the sampling distribution model for sample means:

$\mu_{\bar{x}} = \mu = 2$ ft

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1.5}{\sqrt{3}} = 0.866$ ft

mean of 3 samples



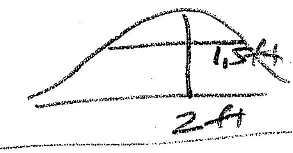
lower upper mean SD

$P(\bar{x}$ of $3 \leq 0) =$ normalcdf$(-999, 0, 2, 0.866)$

$= \boxed{.0105}$

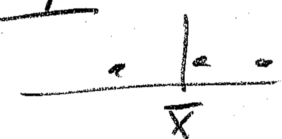
background (don't write this on test)

Population of single measurements



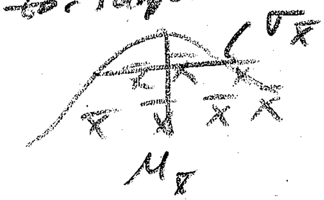
take 3 indp. measurements (this a sample)

Sample



we find the mean of the 3 measurements

Sampling distribution model for sample mean



we need the sampling distr model to analyze how 'mean of 3 at a time' varies