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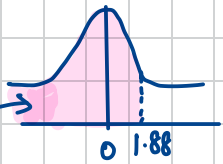
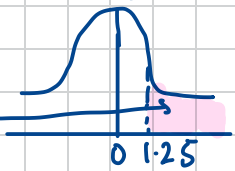
3·4: The standard normal distribution

① $Z \sim N(0, 1^2)$

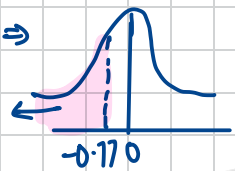
a) $P(Z < 1.88) \Rightarrow$ 0.9699



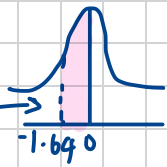
b) $P(Z > 1.25) \Rightarrow$ 0.1056



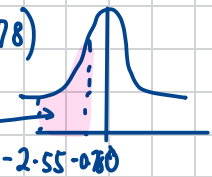
c) $P(Z < -0.77) \Rightarrow$ 0.2206



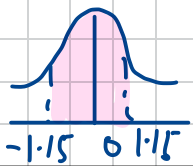
d) $P(-1.64 < Z < 0) \Rightarrow$ 0.4495



e) $P(-2.55 < Z < -0.78) \Rightarrow$ 0.2123

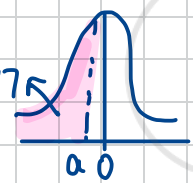


f) $P(-1.15 < Z < 1.15) \Rightarrow$ 0.7499

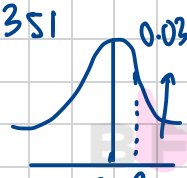


② $Z \sim N(0, 1^2)$

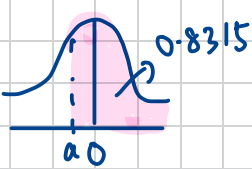
a) $P(Z < a) = 0.9177$
$\Rightarrow a = 1.39$ (3sf)



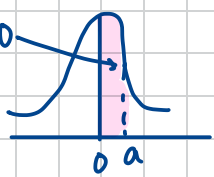
b) $P(Z > a) = 0.0351$
$\Rightarrow a = 1.81$ (3sf)



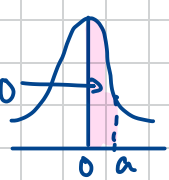
c) $P(Z > a) = 0.8315$
$\Rightarrow a = -0.96$ (3sf)



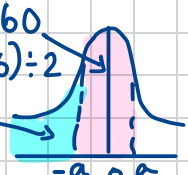
d) $P(0 < Z < a) = 0.1700$
$\Rightarrow P(Z < a) - P(Z < 0)$
$\Rightarrow 0.4399 - 0$
$a = 0.440$ (3sf)



e) $P(0 < Z < a) = 0.4970$
$\Rightarrow P(Z < a) - P(Z < 0)$
$\Rightarrow a = 2.75$ (3sf)



f) $P(-a < Z < a) = 0.60$
$\Rightarrow P(Z < -a) = 0.5 - (0.6) \div 2$
$\Rightarrow P(Z < -a) = 0.2$
$\Rightarrow a = 0.842$ (3sf)



③ $X \sim N(1.4, 0.25^2)$; $Z \sim N(0, 1^2)$

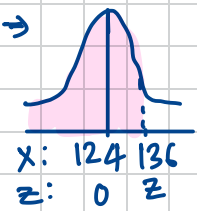
a) $x = 1.2$
$\Rightarrow z = \frac{x - \mu}{\sigma}$
$\Rightarrow \frac{1.2 - 1.4}{0.25}$
$\Rightarrow -0.8$

b) $x = 0.625$
$\Rightarrow z = \frac{x - \mu}{\sigma}$
$\Rightarrow \frac{0.625 - 1.4}{0.25}$
$\Rightarrow -3.1$

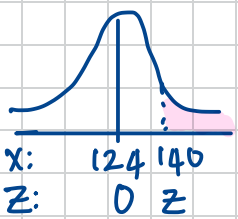
c) $x = 0.64$
$\Rightarrow z = \frac{x - \mu}{\sigma}$
$\Rightarrow \frac{0.64 - 1.4}{0.25}$
$\Rightarrow -3.04$

d) $x = 1.981$
$\Rightarrow z = \frac{x - \mu}{\sigma}$
$\Rightarrow \frac{1.981 - 1.4}{0.25}$
$\Rightarrow 2.324$

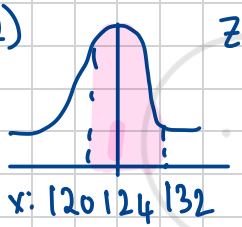
④ $X \sim N(124, 10^2)$

a) $P(X < 136) \Rightarrow$ 

$\Rightarrow z = \frac{136-124}{10} \Rightarrow z = 1.2$
$\Rightarrow \Phi(1.2)$

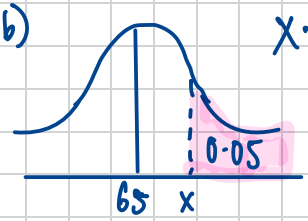
b) $P(X > 140)$ 

$\Rightarrow z = \frac{140-124}{10} \Rightarrow z = 1.6$
$\Rightarrow 1 - \Phi(1.6)$

c) $P(120 < X < 132)$ 

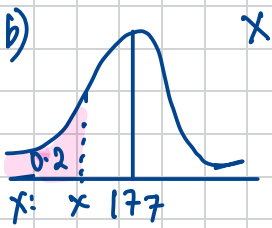
$z = \frac{120-124}{10} \Rightarrow z = -0.4$
$z: \frac{132-124}{10} \Rightarrow z = 0.8 \Rightarrow$
$\Rightarrow \Phi(0.8) + \Phi(0.4) - 1$

⑤ a) $P(Z > z) = 0.05 \Rightarrow z = 1.645$ (3 s.f)

b) 

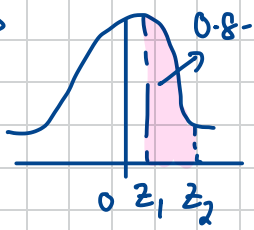
$X \sim N(65, 7.2^2) \Rightarrow x = 76.842 \Rightarrow X = 77$ (2 SF)

⑥ a) $P(Z < z) = 0.2 \Rightarrow z = -0.8416$ (3sf)

b) 

$X \sim N(177, 33) = P(X < x) = 0.2 \Rightarrow X = £150$

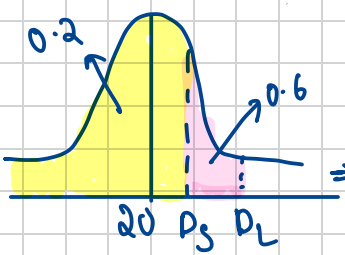
(7) a) 20% to 80% ⇒



$\Rightarrow P(z_1 < Z < z_2) = 0.6$

$\Rightarrow -0.8416 \leq Z \leq 0.8416$

b) $D \sim N(20, 1.5^2)$



$\Rightarrow P(D \leq D_S) = 0.2 \Rightarrow D_S = 18.74$ cm (4sf)

$\Rightarrow P(D \leq D_L) = 0.8 \Rightarrow D_L = 21.26$ cm (4sf)

$\Rightarrow$ Smallest: $D = 18.74$ cm; largest: $D = 21.26$ cm (4sf)