

**Author: Naga Karthik**

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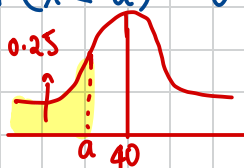
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### 3.3: The inverse normal distribution function.

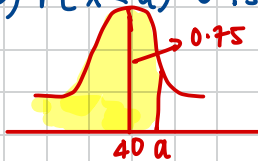
①  $X \sim N(40, 3^2)$

a)  $P(X < a) = 0.25$



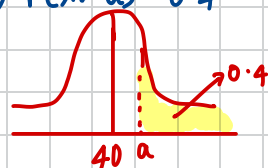
$a = 37.98$

b)  $P(X < a) = 0.75$



$a = 42.02$

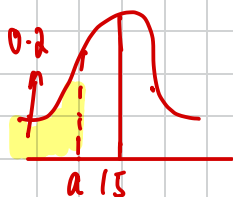
c)  $P(X > a) = 0.4$



$a = 40.76$

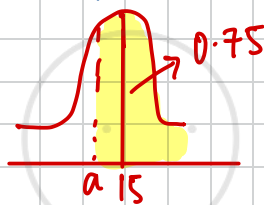
②  $X \sim N(15, 2^2)$

a)  $P(X < a) = 0.2$



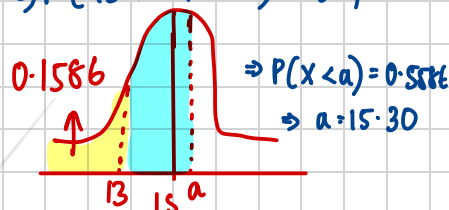
$a = 13.32$

b)  $P(X > a) = 0.75$



$a = 13.65$

c)  $P(13 \leq X \leq a) = 0.4$

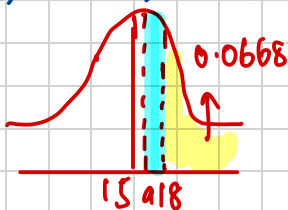


$\Rightarrow P(X < a) = 0.5586$   
 $\Rightarrow a = 15.30$

$P(X < 13) = 0.1586$

$\Rightarrow 0.4 + 0.1586 = 0.5586 > 0.5$

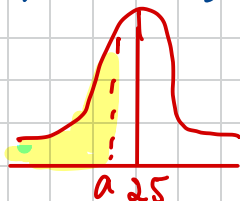
d)  $P(a < X < 18) = 0.43$



$P(X > 18) = 0.0668$   
 $\Rightarrow 0.0668 + 0.43 = 0.4968$   
 $P(X > a) = 0.4968$   
 $a = 15.02$

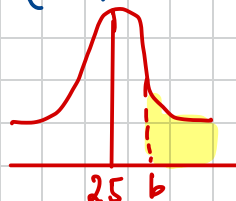
②  $X \sim N(25, 15)$   $\rightarrow \sigma = \sqrt{15}$

a) i)  $P(X < a) = 0.303$



$a = 23.00$

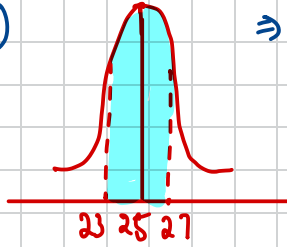
ii)  $P(X > b) = 0.303$



$b = 27.00$

c)  $P(b < X < a)$

$\Rightarrow P(b < X < a) = P(a < X < b) = 0.394$

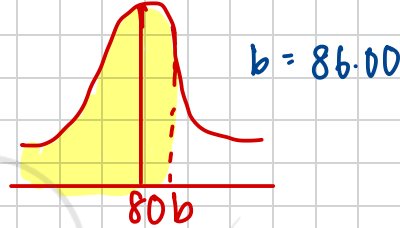
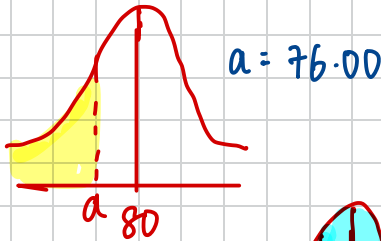


④  $Y \sim N(80, 25)$

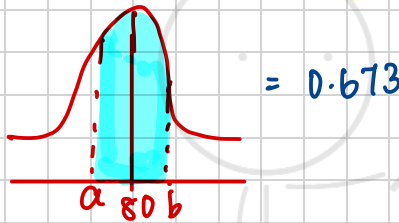
$\sigma = 5$

a) i)  $P(Y < a) = 0.212$

ii)  $P(Y < b) = 0.885$



b)  $P(a < Y < b)$



$= 0.673$

⑤  $X \sim N(100, 36)$

$\sigma = 6$

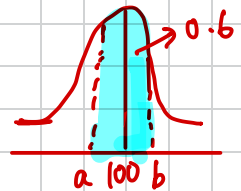
a)  $P(a < X < b) = 0.6$ , as the normal distribution is symmetric

$\Rightarrow \frac{0.6}{2} = 0.3 \Rightarrow 0.5 + 0.3 = 0.8$  — ① Upper tail

$0.5 - 0.3 = 0.2$  — ② Lower tail

$\Rightarrow P(X < a) = 0.2 \Rightarrow a = 94.9$  (3sf)

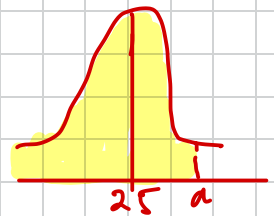
$P(X < b) = 0.8 \Rightarrow b = 105$  (3sf)



b) For any value of  $a$  chosen, where  $P(X < a) \leq 0.4$ , there is a value of  $b$  such that  $P(a < X < b) = 0.6$ .

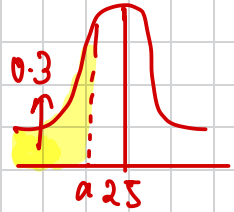
⑥  $D \sim N(25, 7^2)$

a) 75<sup>th</sup> percentile  $\rightarrow P(X < a) = 0.75$   
 $a = 29.7$



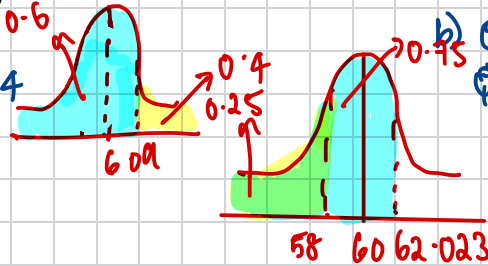
b) 30<sup>th</sup> percentile  $\Rightarrow P(X < a) = 0.3 \Rightarrow a = 21.3$

c) the value of  $Q_2$ : 25



⑦  $X \sim N(60, 3^2)$

a)  $P(X > a) = 0.4$   
 $\Rightarrow a = 60.8$

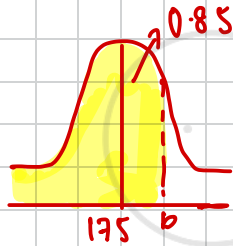


b)  $Q_1 \rightarrow$  Lower quartile: 0.25  
 $Q_3 \rightarrow$  Upper quartile: 0.75

$Q_3 - Q_2 \Rightarrow 62.023 - 57.976$   
 $\Rightarrow 4.05$

⑧  $W \sim N(175, 16^2)$

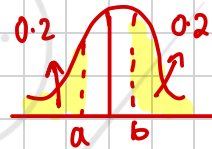
a)  $P(Y < b) = 0.85$   
 $b = 185$  (3sf)



b) 20% to 80%  $\Rightarrow P(X < a) = 0.2$

$P(X < b) = 0.8$

$\Rightarrow a = 166.58$   $b = 183.41$



$\Rightarrow b - a = 183.41 - 166.58$   
 $\Rightarrow 16.8$  (3sf)

⑨  $H \sim N(100, 6^2)$



$P(H > 100+k) = 0.1379$

$\Rightarrow 100+k = 106.97 \Rightarrow k = 6.97$   $k = 7$