3.4) The standard normal distribution

Worked example	Your turn
Z is the number of standard deviations above the mean.	Z is the number of standard deviations above the mean.
Assume $X \sim N(100, 15^2)$	Assume $X \sim N(100, 15^2)$
Find z if	Find Z if
$X = 100$	$X = 85$ $Z = -1$
$X = 130$	$X = 165$ $Z = 4.3333 \ldots$
$X = 62.5$	

Worked example	Your turn
The random variable $X \sim N(40, 5^2)$. Write in terms of $\Phi(z)$ for some value of z. (a) $P(X \leq 45)$ (b) $P(X > 43)$	The random variable $X \sim N(50, 4^2)$. Write in terms of $\Phi(z)$ for some value of z. (a) $P(X < 53)$ (b) $P(X \geq 55)$ a) $\Phi(0.75)$ b) $1 - \Phi(1.25)$

Worked example	Your turn
If $X \sim N(100, 15^2)$, determine, in terms of Φ: (a) $P(X > 70)$ (b) $P(88 < X < 122.5)$	If $X \sim N(100, 15^2)$, determine, in terms of Φ: (a) $P(X > 115)$ (b) $P(77.5 < X < 112)$ a) $1 - \Phi(1)$ b) $\Phi(0.8) + \Phi(1.5) - 1$

Worked example	Your turn
The systolic blood pressure of an adult population, S mmHg, is modelled as a normal distribution with mean 721 and standard deviation 4. A medical research wants to study adults with blood pressures higher than the 90th percentile. Find the minimum blood pressure for an adult included in her study.	The systolic blood pressure of an adult population, S mmHg, is modelled as a normal distribution with mean 127 and standard deviation 16. A medical researcher wants to study adults with blood pressures higher than the 95th percentile. Find the minimum blood pressure for an adult included in her study. $s = 153$ (3 sf)

Worked example	Your turn
Determine: $P(Z > -1.7)$ $P(Z \leq -1.5)$	Determine: $P(Z > -1.3)$ 0.9032 (4 dp)

Worked example	Your turn
Determine: $$P(-1 < Z < 0)$$ $$P(-1.5 < Z < 0.5)$$	Determine: $$P(-2 < Z < 1)$$ 0.8185 (4 dp)

Worked example

Determine a such that:

$$P(Z > a) = 0.3$$

$$P(Z < a) = 0.4$$

Your turn

Determine a such that:

$$P(Z > a) = 0.7$$

$$a = -0.5244 \text{ (4 dp)}$$

Worked example	Your turn
Determine a such that: $$P(-a < Z < a) = 0.4$$ $$P(-a < Z < a) = 0.5$$	Determine a such that: $$P(-a < Z < a) = 0.6$$ $a = -0.8416$ (4 dp)

Worked example	Your turn
Use the percentage points table to find values of z which correspond to the 10% to 80% interpercentile range.	Use the percentage points table to find values of z which correspond to the 20% to 90% interpercentile range. $-0.8416 < z < 1.2816$