MARKS
8
(4, 4)

6. The mesh size **s** of a gill net is the minimum diameter of fish which can be caught in the net. For a particular species, fish diameters can be modelled by a $N(8, 2)$ distribution for one-year-old fish, by a $N(10, 2)$ distribution for two-year-old fish, and by a $N(12, 2)$ distribution for three-year-old fish.
   (a) What should be the value of **s** to catch 90% of three-year-old fish?
   (b) What proportion of one-year-old fish will be caught with the mesh size found in (a)?

(a) Let the random variable $D3$ represent the diameter (in centimetres) of an equiprobably('randomly')-selected three-year-old fish;

we use the model: $D3 \sim N(12, 2)$.

We want: $\Pr(D3 > \mathbf{s}) = 0.90$,

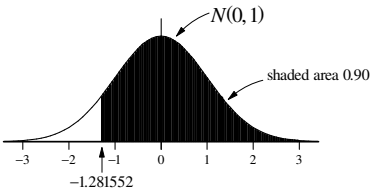
i.e., $\Pr\left(\frac{D3 - \mu}{\sigma} > \frac{\mathbf{s} - 12}{2}\right) = 0.90$ (standardizing),

i.e., $\Pr\left[N(0, 1) > \frac{\mathbf{s} - 12}{2}\right] = 0.90$

$\therefore$ $\frac{\mathbf{s} - 12}{2} = -1.281552$ so that: $\mathbf{s} = 9.4369 \simeq 9.44$ cm;

i.e., the mesh size **s** should be set at about 9.44 cm to catch 90% of three-year-old fish.

9.44 cm (a)
Value of **s**



(b) Let the random variable $D1$ represent the diameter (in centimetres) of an equiprobably('randomly')-selected one-year-old fish;

we use the model: $D1 \sim N(8, 2)$.

We want: $\Pr(D1 > 9.4369) = \Pr[N(8, 2) > 9.4369]$

$= \Pr\left[N(0, 1) > \frac{9.4369 - 8}{2}\right]$ (standardizing)

$= \Pr[N(0, 1) > 0.71845]$

$= 1 - 0.763\,759 = 0.236\,241$;

i.e., about 23.6% of one-year-old fish will be caught in a net with mesh size $\mathbf{s} \simeq 9.44$ cm.

23.6% (b)
Proportion