MARKS

6

8. Suppose that the diameters in millimetres of the eggs laid by a large flock of hens can be modelled by a normal distribution with a mean of 41 mm and a standard deviation of 3 mm. The selling price per dozen is \$1.10 for eggs less than 37 mm in diameter, \$1.50 for those with diameters greater than 43 mm, and \$1.28 for the remainder. What is the average selling price **per egg** produced by the flock?

Let the random variable D represent the diameter (in mm) of an egg selected equiprobably ('at random') from the flock;

we use the model: $D \sim N(41, 3)$.

10.99 ¢

Average price per egg

Then:

$$\Pr(D < 37) = \Pr[N(0,1) < \tfrac{37-41}{3}] = \Pr[N(0,1) < -1.\dot{3}] = 0.09121$$

$$\Pr(D > 43) = \Pr[N(0,1) > \tfrac{43-41}{3}] = \Pr[N(0,1) > 0.\dot{6}] = 0.25250$$

$$\Pr(37 \le D \le 43) = \Pr[-1.\dot{3} \le N(0,1) \le 1.\dot{6}] = 0.28814 + 0.38493 = 0.65629$$

$$1.00000 \quad \text{(OK)}$$

Hence, the average selling price in cents per egg is:

$$0.09121 \times \tfrac{110}{12} + 0.65629 \times \tfrac{128}{12} + 0.25250 \times \tfrac{150}{12}$$

$$= 0.8361 + 7.0004 + 3.1562$$

$$= 10.9928 \simeq 10.99¢ \qquad (\$1.3191 \text{ per dozen});$$

that is, the eggs sell for an average of about 10.99 (close to 11) cents each.