6. The discrete random variable R takes even integer values from 2 to $2n$ inclusive.

The probability distribution of R is given by

$$\mathrm{P}(R = r) = \frac{r}{k} \qquad r = 2, 4, 6, \ldots, 2n$$

where k is a constant.

(a) Show that $k = n(n + 1)$

(4)

When $n = 20$

(b) find the exact value of $\mathrm{P}(16 \leqslant R < 26)$

(2)

When $n = 20$, a random value g of R is taken and the quadratic equation in x

$$x^2 + gx + 3g = 5$$

is formed.

(c) Find the exact probability that the equation has no real roots.

(5)