6.2) The binomial distribution

Worked example	Your turn
The probability of a lightbulb being faulty is 0.12. A random sample of 34 lightbulbs is taken from the production line. a) Define a suitable distribution to model the number of faulty lightbulbs in this sample. b) Find the probability that the sample contains fewer than 3 faulty lightbulbs.	The probability of a bolt being faulty is 0.21. A random sample of 43 bolts is taken from the production line. a) Define a suitable distribution to model the number of faulty bolts in this sample. b) Find the probability that the sample contains fewer than 2 faulty bolts. a) Let X = number of faulty bolts. $X \sim B(43, 0.21)$ b) 0.000493 (3 sf)

Worked example	Your turn
The random variable $X \sim B\left(8, \frac{1}{10}\right)$. Find: a) $P(X = 2)$ b) $P(X = 5)$ c) $P(X \leq 1)$ *d)* $P(X \geq 7)$	The random variable $X \sim B\left(12, \frac{1}{6}\right)$. Find: a) $P(X = 2)$ b) $P(X = 9)$ c) $P(X \leq 1)$ d) $P(X \geq 11)$ a) 0.2961 (4 dp) b) 0.0000126 (3 sf) c) 0.3813 (4 dp) d) 0.000000280 (3 sf)

Worked example	Your turn
A company claims that a third of the lightbulbs sent to them are faulty. To test this claim the number of faulty lightbulbs in a random sample of 100 is recorded. Give two reasons why a binomial distribution may be a suitable model for the number of faulty lightbulbs in the sample.	A company claims that a quarter of the bolts sent to them are faulty. To test this claim the number of faulty bolts in a random sample of 50 is recorded. Give two reasons why a binomial distribution may be a suitable model for the number of faulty bolts in the sample. • Two possible outcomes (bolt faulty or not faulty) • Constant probability of bolt being faulty $(p = \frac{1}{4})$ • A bolt being faulty is independent of other bolts being faulty (assuming they do not influence each other) • 50 bolts in the sample (fixed number of trials)