

The **topics** and **types of questions** examined in this Achievement Standard. Use this sheet to plan and organise your study so that you cover everything that is required.

FREE DOWNLOADS: For more of these Revision Checklists visit www.studypass.co.nz



Copyright © 2009 Growing Minds Ltd.

NCEA Study Packs contain the past NCEA questions for all exams for each of these topics. Full answers, explanations and a set of summary course notes. View all titles at www.studypass.co.nz



3.6 PROBABILITY DISTRIBUTION MODELS AS 90646

Use probability distribution models to solve straightforward problems

3.6 1. Binomial and Poisson distributions A M

- using binomial and Poisson distributions to solve straightforward problems A
- combined events M

▶ A pulp and paper mill has, on average, 1 serious accident every two months. Assuming that the number of serious accidents per two-month period has a Poisson distribution, find the probability that:

- 3 serious accidents occur over a two-month period.
- 3 serious accidents occur in **one** month.

▶ John has to pass through six sets of traffic lights on his way to work. If he has to stop at **more than** four sets of lights, then he will be late for work. The sets of traffic lights operate independently of each other.

The probability that John will have to stop at any one of the sets of traffic lights is 0.4.

Find the probability that John will be late for work.

▶ A food crop inspector notices that some of the potatoes are a very unusual shape. Further studies suggest that the occurrence of these unusually-shaped potatoes appears to be entirely random.

The inspector discovers that potatoes with the very unusual shape occur on average in one potato plant per hectare in the region.

Over a two-day period the inspector is checking for the presence of the unusually-shaped potatoes in plants from the region. On each day, an area of five hectares will be randomly chosen, and the plants studied.

What is the probability that on both days the inspector finds no plants with the unusually-shaped potatoes?

3.6 2. Normal distribution A M

- using normal distribution to solve straightforward problems A

▶ Research has shown that the times taken for walkers to complete a track through a particular national park are normally distributed with a mean of 3.6 hours and a standard deviation of 0.5 hours.

Calculate the probability that a randomly selected walker will take less than 3 hours to complete the track.

▶ At Elizabeth and John's home the mail is delivered in the morning. The delivery times are normally distributed with a mean of 10:20 am and a standard deviation of 18 minutes.

Find the probability that on any particular day the mail will be delivered between 10 am and 11 am.

- inverse normal problems M

▶ A researcher's studies have shown that the weights of takahē chicks at age one week can be taken to be normally distributed with a mean weight of 207 g and a standard deviation of 18 g.

The researcher claims that 12% of all takahē chicks are underweight. For a one-week-old takahē chick, what is the maximum weight that can be considered to be underweight?

▶ Jack makes omelettes from emu eggs at the Farmer's Market. Each omelette uses one emu egg. The weights of emu eggs are normally distributed. It is known that 90% of the time the weight of the final omelette is more than 752 g. Assume that the weight of all other ingredients is negligible.

Given that the weights of emu eggs have a standard deviation of 21.3 g, calculate the mean weight of emu eggs.

- combined events M
- continuity correction where appropriate M

3.6 3. Combining normal distributions M

- sum of two normally distributed, independent variables

▶ Fiordland National Park is home to the takahē. The takahē is a bird that is native to New Zealand, and is listed as being an endangered species.

Two adult takahē are to be captured and used as part of a breeding programme to help protect the species. Research has shown that the weights of adult takahē can be taken to be normally distributed, with a mean weight of 3.0 kg and a standard deviation of 0.4 kg.

Assuming that the weights of the adult takahē to be captured are independent, calculate the probability that the combined weight of the two randomly chosen adult takahē exceeds 7 kg.

3.6 4. Solve complex problems E

- inverse Poisson
- linear combinations of normally distributed, independent variables e.g. $aX + bY$ and $X_1 + X_2 + X_3 + \dots + X_n$
- selecting and justifying the use of a model

▶ Clare sells duck and goose eggs. She packages these in a carton containing four duck eggs and two goose eggs.

The weights of duck eggs are normally distributed, with a mean weight of 82.8 g and a standard deviation of 6.98 g. The weights of goose eggs are normally distributed with a mean weight of 146.3 g and a standard deviation of 1.96 g.

Assuming that the eggs are selected independently, calculate the probability that the total weight of eggs in a carton is between 600 g and 650 g.