

Question 4

(50 marks)

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A car rental company has been using *Evertread* tyres on their fleet of economy cars. All cars in this fleet are identical. The company manages the tyres on each car in such a way that the four tyres all wear out at the same time. The company keeps a record of the lifespan of each set of tyres. The records show that the lifespan of these sets of tyres is normally distributed with mean 45 000 km and standard deviation 8000 km.

Note: The word "sample" is not mentioned

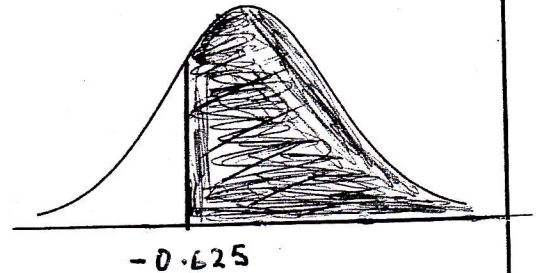
- (a) A car from the economy fleet is chosen at random. Find the probability that the tyres on this car will last for at least 40 000 km.

Solution:

$$Z = \frac{x - \mu}{\sigma} = \frac{40,000 - 45,000}{8,000} = -0.625$$

Tables :  $P(Z \geq -0.625)$

$$= 0.7341$$



- (b) Twenty cars from the economy fleet are chosen at random. Find the probability that the tyres on at least eighteen of these cars will last for more than 40 000 km.

Solution: (using two decimal places for  $p$ )

Now we have a Binomial Distribution.

$$p = 0.73, \quad q = 1 - 0.73 = 0.27, \quad n = 20$$

$$P(X=20) + P(X=19) + P(X=18)$$

$$= \binom{20}{0} (0.73)^{20} (0.27)^0 + \binom{20}{1} (0.73)^{19} (0.27)^1 + \binom{20}{2} (0.73)^{18} (0.27)^2$$

$$= 0.05$$

- (c) The company is considering switching brands from *Evertread* tyres to *SafeRun* tyres, because they are cheaper. The distributors of *SafeRun* tyres claim that these tyres have the same mean lifespan as *Evertread* tyres. The car rental company wants to check this claim before they switch brands. They have enough data on *Evertread* tyres to regard these as a known population. They want to test a sample of *SafeRun* tyres against it.

The company selects 25 cars at random from the economy fleet and fits them with the new tyres. For these cars, it is found that the mean life span of the tyres is 43 850 km.

Test, at the 5% level of significance, the hypothesis that the mean lifespan of *SafeRun* tyres is the same as the mean of *Evertread* tyres. State clearly what the company can conclude about the tyres.

Solution: