

Statistics 20 – Standardised Normal Distribution

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics.

Please complete all questions.

1. $X \sim N(30, 4^2)$

Find:

- a) $P(20 < X < 38)$
- b) $P(X < 25)$
- c) $P(X > 20)$

2. The weight of a small loaf of bread is normally distributed with a mean of 500 grams and a standard deviation of 20 grams. Find the probability that a randomly chosen loaf has a weight:

- a) At most 480 grams
- b) Not exceeding 510 grams
- c) Not less than 450 grams

3. IQ scores are normally distributed with a mean of 100 and a standard deviation of 15.

- a) Determine the probability that a person chosen at random has an IQ above 130
- b) People with an IQ above 130 are allowed to join a club for those with Special Mental Urgent Generalisation Skills (SMUGS). Find the probability that out of a group of 20 people selected from the population at random, at least 3 of them are able to join the SMUGS club

4. $X \sim N(50, 8^2)$

Find the value of x for each of the following situations:

- a) $P(X < x) = 0.3$
- b) $P(X > x) = 0.2$
- c) $P(50 < X < x) = 0.3$
- d) $P(48 < X < x) = 0.5$

Section 2 – Consolidation of this week's topic.

Please complete all questions.

1. $X \sim N(80, 10^2)$, $Y = X - 80$, $Z = \frac{Y}{10}$

- a) State the mean and standard deviation of:

- i. Y (2 marks)
ii. Z (2 marks)
- b) State the distribution of
i. Y (1 mark)
ii. Z (1 mark)
- c) If $X \sim N(\mu, \sigma^2)$ and $Z \sim N(0, 1^2)$, state the formula that can be used to express an individual Z value (z) in terms of x, μ and σ (1 mark)
2. $Z \sim N(0, 1^2)$
Use your calculator to find the following probabilities
a) $P(Z > 2.1)$ (1 mark)
b) $P(Z < 1.65)$ (1 mark)
c) $P(Z > -1.65)$ (1 mark)
d) $P(Z < -2.1)$ (1 mark)
e) Explain, by using sketches, why it makes sense that some of the answers to the previous parts of this question are the same (2 marks)
3. $Z \sim N(0, 1^2)$
Use your calculator to find the value of z for each of the following situations:
a) $P(Z < z) = 0.3$ (1 mark)
b) $P(Z > z) = 0.9$ (1 mark)
c) $P(0 < Z < z) = 0.25$ (2 marks)
d) $P(-1.2 < Z < z) = 0.4$ (2 marks)
4.
a) Use the percentage points table (pg 191 of online textbook) to find the z values that satisfy the following:
i. $P(Z > z) = 0.01$ (1 mark)
ii. $P(Z > z) = 0.3$ (1 mark)
iii. $P(Z > z) = 0.15$ (1 mark)
b) Hence find the z values that satisfy the following:
i. $P(Z < z) = 0.01$ (1 mark)
ii. $P(Z < z) = 0.3$ (1 mark)
iii. $P(Z < z) = 0.15$ (1 mark)
iv. $P(Z < z) = 0.99$ (1 mark)
v. $P(Z > z) = 0.7$ (1 mark)
vi. $P(Z < z) = 0.85$ (1 mark)
vii. $P(Z > z) = 0.85$ (1 mark)
5.
a) Use the percentage points table to find the value of z such that
i. $P(Z > z) = 0.8$ (2 marks)
ii. $P(Z < z) = 0.8$ (1 mark)
b) Bananas have lengths that are normally distributed with a mean of 22cm and a standard deviation of 1.5cm. Use one of your answers from a) to determine the length exceeded by 80% of bananas (3 marks)

Total: 35 Marks