

Please write ***Your name:*** \_\_\_\_\_

**Show all work.** You should either write at a sentence explaining your reasoning, or annotate your math work with brief explanations. There is no need to simplify, and no calculators are needed.

.....  
 In this quiz use the notation  $\Phi(x)$  for the distribution function for  $\mathcal{N}(0, 1)$ , that is

$$\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-y^2/2} dy = \mathbb{P}(Z < x)$$

where  $Z$  is the standard normal random variable.  
 .....

- (1) Find a formula for  $\mathbb{P}(-1 \leq X \leq 3)$  if  $X$  is  $\mathcal{N}(-1, 4)$ . Your answer should include  $\Phi$  twice. Do not use the normal table in this question.

- (2) Find the numerical value for  $\mathbb{P}(-1 \leq X \leq 3)$  if  $X$  is  $\mathcal{N}(-1, 4)$ . Use the normal table attached in the end of the quiz.

- (3) Suppose a fair coin is tossed 25 times. Find a formula for a normal approximation for the probability to have at least 15 heads. Your answer should include  $\Phi$ .
- (4) Find a numerical approximation for the probability to have at least 15 heads. Use the normal table attached in the end of the quiz.

(5) Let  $S_n$  be the number of heads in  $n$  coin tosses. How many times do you need to toss a coin so that standard deviation of  $S_n$  is 5?

(6) For this value of  $n$ , estimate the probability to have at least 40 heads using the table.

(End of the quiz, the normal table is on the next page)