**AP STATISTICS • EXERCISE SHEET**

# 4.8 Mean and Standard Deviation of Random Variables

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

**KEY WORDS** mean (expected value) 期望值 • random 随机 • probability 概率 • random variable 随机变量

## Objective

Build the skills to answer exam questions on **the mean and standard deviation of random variables**.

**You must be able to:**

- calculate the **mean** (expected value) 期望值 $\mu_X = \sum x_i \cdot P(x_i)$
- calculate the **standard deviation** $\sigma_X = \sqrt{\sum (x_i - \mu_X)^2 \cdot P(x_i)}$
- interpret these parameters in context

## 1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ **Mean (expected value)**

$$\mu_X = \sum x_i \cdot P(x_i)$$

— a probability-weighted average of the values.

■ **Standard deviation**

$$\sigma_X = \sqrt{\sum (x_i - \mu_X)^2 \cdot P(x_i)}.$$

■ **Example**

$X$: 0 (prob 0.5), 1 (prob 0.3), 2 (prob 0.2):

$$\mu_X = 0(0.5) + 1(0.3) + 2(0.2) = 0.7.$$

## 2 Practice

**2.1** Write the formula for the mean of a discrete random variable. [1]

**2.2** $X$ takes 1 (prob 0.5) and 3 (prob 0.5). Find the mean. [2]

**2.3** State what the mean of a random variable is also called. [1]

## 3 Exam-style questions

**3.1** The expected value of $X$ is [1]

- **A** $\sum x_i$
- **B** $\sum x_i \cdot P(x_i)$
- **C** $\sum P(x_i)$
- **D** the largest value of $x$

**3.2** The mean of a random variable is also called its [1]

- **A** median
- **B** expected value
- **C** mode
- **D** variance

**3.3** $X$ takes 2 (prob 0.4) and 5 (prob 0.6).

(a) Find the mean. [2]

(b) State what the probabilities sum to. [1]

## Solutions

**2.1** $\mu_X = \sum x_i \cdot P(x_i)$.

**2.2** $\mu_X = 1(0.5) + 3(0.5) = 2$.

**2.3** the expected value.

**3.1 B**.

**3.2 B**.

**3.3** (a) $\mu_X = 2(0.4) + 5(0.6) = 0.8 + 3 = 3.8$. (b) 1.