Jasmine is researching the heights of pine trees in forests in two regions A and B. She chooses a random sample of 50 pine trees in region A and records their heights, x m. She also chooses a random sample of 60 pine trees in region B and records their heights, y m. Her results are summarised as follows.

$$\Sigma x = 1625$$
  $\Sigma x^2 = 53200$   $\Sigma y = 1854$   $\Sigma y^2 = 57900$ 

Find a 95% confidence interval for regions <i>A</i> and <i>B</i> .	the difference between the population mean heights of pine trees in [7]
	15921

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500	

An organisation runs courses to train students to become engineers. These students are taught in groups of 8. The director of the organisation claims that on average 60% of the students in a group achieve a pass. A random sample of 150 groups of 8 students is chosen. The following table shows the observed frequencies together with some of the expected frequencies using the appropriate binomial distribution.

Number of passes per group	0	1	2	3	4	5	6	7	8
Observed frequency	0	0	8	24	45	36	26	10	1
Expected frequency	p	1.180	6.193	18.579	34.836	q	r	13.437	2.519

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3 A large college is holding a piano competition. Each student has played a particular piece of music and two judges have each awarded a mark out of 80. The marks awarded to a random sample of 14 students are shown in the following table.

Student	A	В	C	D	E	F	G	Н	I	J	K	L	M	N
Judge 1	79	54	63	74	69	52	50	57	55	42	63	55	56	48
Judge 2	75	62	60	73	76	41	31	51	45	55	49	50	65	36

(a)	One of the students claims that on average Judge 1 is awarding higher marks than Judge 2. Carry out a Wilcoxon matched-pairs signed-rank test at the 5% significance level to test whether the data supports the student's claim. [7]
	592

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(a)	Find the probability generating function $G_X(t)$ of $X$ .	[3]
	on also has two unbiased coins. He throws all five coins. The number of heads obtained to unbiased coins is denoted by $Y$ . It is given that $G_{i}(t) = \frac{1}{2} + \frac{1}{2}t + \frac{1}{2}t^{2}$ . The random variable	
wo	on also has two unbiased coins. He throws all five coins. The number of heads obtained to unbiased coins is denoted by $Y$ . It is given that $G_Y(t) = \frac{1}{4} + \frac{1}{2}t + \frac{1}{4}t^2$ . The random variable all number of heads obtained when Jason throws all five coins.	
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(c)	Find $E(Z)$ .	[2]

5 The continuous random variable X has cumulative distribution function F given by

$$F(x) = \begin{cases} 0 & x < 0, \\ 1 - \frac{1}{144} (12 - x)^2 & 0 \le x \le 12, \\ 1 & x > 12. \end{cases}$$

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The	random variable $Y$ is given by $Y =$	$\sqrt{X}$	
	Find the probability density functi		[3]

A company manufactures copper pipes. The pipes are produced by two different machines, A and B. An inspector claims that the mean diameter of the pipes produced by machine A is greater than the mean diameter of the pipes produced by machine B. He takes a random sample of 12 pipes produced by machine A and measures their diameters, x cm. His results are summarised as follows.

$$\sum x = 6.24$$
  $\sum x^2 = 3.26$ 

He also takes a random sample of 10 pipes produced by machine *B* and measures their diameters in cm. His results are as follows.

The diameters of the pipes produced by each machine are assumed to be normally distributed with equal population variances.

Test at the 2.5% significance level whether the data supports the inspector's claim. [9]

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