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6. A manufacturer has a machine that fills bags with flour such that the weight of flour in a bag is normally distributed. A label states that each bag should contain 1 kg of flour.

(a) The machine is set so that the weight of flour in a bag has mean 1.04 kg and standard deviation 0.17 kg. Find the proportion of bags that weigh less than the stated weight of 1 kg.

(3)

The manufacturer wants to reduce the number of bags which contain less than the stated weight of 1 kg. At first she decides to adjust the mean but not the standard deviation so that only 5% of the bags filled are below the stated weight of 1 kg.

(b) Find the adjusted mean.

(3)

The manufacturer finds that a lot of the bags are overflowing with flour when the mean is adjusted, so decides to adjust the standard deviation instead to make the machine more accurate. The machine is set back to a mean of 1.04 kg. The manufacturer wants 1% of bags to be under 1 kg.

(c) Find the adjusted standard deviation. Give your answer to 3 significant figures.

(3)

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P 4 3 1 4 0 A 0 1 8 2 8

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Question 6 continued

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Question 6 continued

Question Number	Scheme	Marks
6. (a)	$\left[X \sim N(1.04,\ 0.17^2) \right]$	
	$P(X<1)=P\left(Z < \dfrac{1-1.04}{0.17} \right)$	M1
	$= P(Z < -0.23529...)$	
	$= 1 - 0.5948 = 0.4052$ (Accept 0.405-0.407)	M1A1
		(3)
(b)	$P(Y<1) = 0.05$ $\left[Y \sim N(\mu,\ 0.17^2) \right]$	
	$\dfrac{1-\mu}{0.17} = -1.6449$	M1 B1
	$\mu = 1 + 1.6449 \times 0.17 = 1.2796\ldots$ awrt 1.28	A1
		(3)
(c)	$P(S<1) = 0.01$ $\left[S \sim N(1.04,\ \sigma^2) \right]$	
	$\dfrac{1-1.04}{\sigma} = -2.3263$	M1B1
	$\sigma = \dfrac{0.04}{2.3263} = 0.0171946...$ awrt 0.0172	A1
		(3)
		Total 9
	Notes	
(a)	1st M1 for attempting to standardise with 1, 1.04 and 0.17 Allow $\pm$ 2nd M1 for attempting $1 - p$ where $(0.5 < p < 0.6)$ A1 for answers in the range $0.405 \sim 0.407$ (Calc gives 0.4069902…) Allow any alternative letters to μ and σ in parts (b) and (c)	

(b)	M1 for an attempt to standardise (allow $\pm$) with 1, 0.17 and μ and set $= \pm$ any z value ($\lvert z \rvert > 1$)
	 B1 for $z = \pm\, 1.6449$ (or better. Calc gives 1.6448536..) used as a z value. Do not allow $1 - 1.6449$
	      [May be implied by answer that rounds to 1.2796]
	 A1 for awrt 1.28 (can be scored for using a z value of 1.64 or 1.65)
	      Must follow from correct working but a range of possible z values are OK	

Ans only	If answer is awrt 1.28 score M1B0A1 (unless of course $z = 1.6449$ seen) but awrt 1.2796 scores 3/3	
(c)	M1 for an attempt to standardise with 1, 1.04 and σ and set $= \pm$ any z value ($\lvert z \rvert > 2$) B1 for $z = \pm\, 2.3263$ (or better) (Calc gives 2.3263478…) used as a z value If B0 scored in (b) for using a value in [1.64, 1.65] but not 1.6449 or better, allow awrt 2.32 or 2.33 here A1 for awrt 0.0172 Must follow from correct working but a range of possible z values are OK	
Ans only	If answer is awrt 0.0172 score M1B0A1 (unless of course $z = 2.3263$ or better is seen) If B1 scored in (b) and $z = 2.3263$ or better is <u>not</u> seen here then require an answer in the range $0.17194 < \sigma < 0.17195$ to award 3/3	