

1.  $\bar{m} = \frac{6.7+7.2+\dots+7.3}{10} = 6.91$  (M1)A1

$s_{n-1}^2 = \frac{1}{9}((6.7 - 6.91)^2 + \dots + (7.3 - 6.91)^2)$  (M1)

$= \frac{0.489}{9} = 0.0543$  (3 sf) A1

**Note:** Award M1A0 for 0.233.

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2. (a) (i)  $a, 2a, 3a, \dots, na$  are  $n$  consecutive terms of an AP with first term  $a$  and common difference  $a$

so their mean is  $\frac{a+2a+3a+\dots+na}{n} = \frac{a \frac{n(n+1)}{2}}{n} = \frac{a(n+1)}{2}$  M1A1 AG N0

(ii)  $4 + 2 \times 4 + 3 \times 4 + \dots + 4n > \frac{4(n+1)}{2} + 100$  M1

$\frac{4n(n+1)}{2} > 2(n+1) + 100$  A1

$2n^2 + 2n > 2n + 102$   
attempt to solve (M1)

$n^2 > 51$   
so the minimum value of  $n$  that satisfies the condition is 8 A1 N0

**Note:** Award M1A1(M1)A1 for use of equations if there is a clear conversion to an inequality.

(b) (i)  $M = \frac{x_1 + \dots + x_m + y_1 + \dots + y_n}{m+n}$  M1

$= \frac{0 \times m + 1 \times n}{m+n}$  A1

$= \frac{n}{m+n}$  AG N0

**EITHER**

$$S = \sqrt{\frac{\left(0 - \frac{n}{m+n}\right)^2 \times m + \left(1 - \frac{n}{m+n}\right)^2 \times n}{m+n}}$$

M1A1

attempt to simplify

$$S = \sqrt{\frac{\frac{m^2 n + n^2 m}{(m+n)^2}}{m+n}} = \sqrt{\frac{mn(m+n)}{(m+n)^3}}$$

$$= \sqrt{\frac{mn}{(m+n)^2}}$$

A1

$$= \frac{\sqrt{mn}}{m+n}$$

AG N0

**OR**

$$\text{Var}(x) = \frac{\sum_{i=1}^m x_i^2 + \sum_{i=1}^n y_i^2}{m+n} - M^2$$

M1A1

attempt to simplify

M1

$$\text{Var}(x) = \frac{n}{m+n} - \frac{n^2}{(m+n)^2}$$

$$= \frac{n}{m+n} \left(1 - \frac{n}{m+n}\right)$$

$$= \frac{n}{m+n} \times \frac{m}{m+n}$$

$$= \frac{mn}{(m+n)^2}$$

A1

$$\therefore S = \frac{\sqrt{mn}}{m+n}$$

AG N0

- (ii)  $M = S \Rightarrow \frac{n}{m+n} = \frac{\sqrt{mn}}{m+n}$  A1  
 attempt to solve M1  
 $\Rightarrow n = \sqrt{mn}$   
 $\Rightarrow n = m$ , as  $n > 0$  A1  
 so, then the set has  $2n$  numbers,  $x_1, \dots, x_n, y_1, \dots, y_n$   
 from which the first  $n$  are all 0 and the last  $n$  are all 1 (M1)  
 hence the value of the median is  $\frac{x_n + y_1}{2} = \frac{1}{2}$  A1 N0

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3. (a) 64 A1
- (b) (i) 90 percentile = 87 minimum mark = 87 (accept 88) (M1)A1  
 (ii) 70 percentile = 74 minimum mark = 74 (accept 73) (M1)A1

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