Question Number	Scheme	Marks
6 (a)	e.g. based solely on **known observations** or e.g. contains **no unknown** (population) **parameters**	B1
		(1)
(b)	$\left[\mathrm{E}(R)=\frac{1}{2}\mathrm{E}(X_1)+\frac{3}{4}\mathrm{E}(X_{20})\right]=\frac{1}{2}\mu+\frac{3}{4}\mu$	M1
	$\mathrm{E}(R)=\frac{1}{2}\mu+\frac{3}{4}\mu=\frac{5}{4}\mu\neq\mu$ e.g. So R is a biased estimator for μ	A1
		(2)
(c)	$'\frac{5}{4}\mu'-\mu=\frac{1}{4}\mu$	B1ft
		(1)
(d)	**One of** $a-b=2$ oe **or** $14a+6b=20$ oe **or** $\frac{a-b}{2}=\frac{14a+6b}{20}$ $\left[-4b=a\right]$ oe	B1
	Two of $a-b=2$ oe **,** $14a+6b=20$ oe , $\frac{a-b}{2}=\frac{14a+6b}{20}$ oe	B1
	Solves simultaneously e.g. $14a+6(a-2)=20\Rightarrow a=...,\ b=...$	M1
	a =1.6 oe, b = −0.4 oe	A1
		(4)

	Notes	**Total 8**
(a)	**B1**	For a correct explanation. Allow a valid explanation which suggests one of the following that it is • based (solely) on observations/calculations/values/information/data oe • contains no unknown (population) parameters • calculated/measured • numerical property of a sample/derived from a sample Do not allow "because it is known" (too vague) but condone "because X_1 and X_{20} are known"
(b)	**M1**	For use of $\mathrm{E}(R)=a\mathrm{E}(X_1)+b\mathrm{E}(X_{20})$. May be implied by a correct expression or $\frac{5}{4}\mu$
	A1	Requires an expression in terms of μ before proceeding to a correct simplified value of $\frac{5}{4}\mu$, a reason (e.g. $\neq\mu$) **and** a conclusion (e.g. biased estimator). Must see use of expectation notation e.g. $\mathrm{E}(R)$ or $\frac{1}{2}\mathrm{E}(X_1)+\frac{3}{4}\mathrm{E}(X_{20})$
(c)	**B1ft**	Follow through their part (b) $-\mu$ Their part (b) must be in terms of μ. May be seen in (b)
(d)	**B1**	For a correct equation in a and b only. μ must not be present
	dB1	Dep on 1st B1. For a second different correct equation in a and b only. μ must not be present
	M1	Dependent on at least one correct equation. For solving simultaneously and proceeding to values for a and b. You do not need to be concerned with the mechanics of the rearrangement as long as values for a and b are achieved. May be implied by a correct value for a or a correct value for b.
	A1	For correct values of a and b