Question 1

Solve, giving your answers in surd form:

$$2(x-2)^2 = \frac{13}{3}$$

Question 2
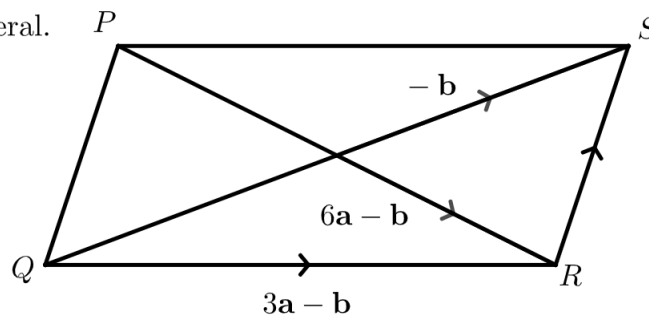
$PQRS$ is a quadrilateral.

$\overrightarrow{QR} = 3\mathbf{a} - \mathbf{b}$

$\overrightarrow{QS} = -\mathbf{b}$

$\overrightarrow{PR} = 6\mathbf{a} - \mathbf{b}$

Show that $PQRS$ is a parallelogram.

## Question 1

Solve, giving your answers in surd form:

$2(x-2)^2 = \dfrac{13}{3}$

$(x-2)^2 = \dfrac{13}{6}$

$x - 2 = \pm \dfrac{\sqrt{13}}{\sqrt{6}}$

$\phantom{x-2} = \pm \dfrac{\sqrt{78}}{6}$

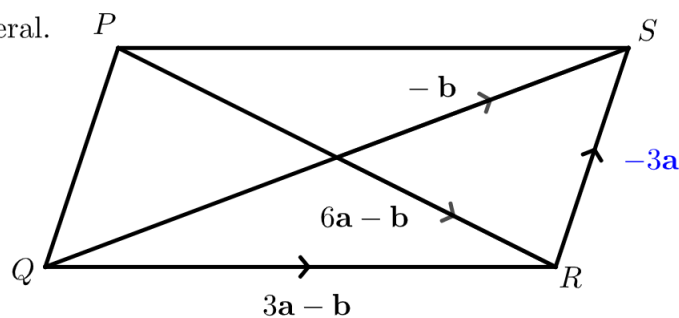$x = 2 + \dfrac{\sqrt{78}}{6}, \ x = 2 - \dfrac{\sqrt{78}}{6}$

## Question 2

$PQRS$ is a quadrilateral.

$\overrightarrow{QR} = 3\mathbf{a} - \mathbf{b}$

$\overrightarrow{QS} = -\mathbf{b}$

$\overrightarrow{PR} = 6\mathbf{a} - \mathbf{b}$

Show that $PQRS$ is a parallelogram.

First note that $\overrightarrow{RS} = \overrightarrow{RQ} + \overrightarrow{QS} = -\overrightarrow{QR} + \overrightarrow{QS} = -(3\mathbf{a} - \mathbf{b}) + (-\mathbf{b}) = -3\mathbf{a}$

To show that $PQRS$ is a parallelogram, it is sufficient to show that $\overrightarrow{PS} = \overrightarrow{QR}$ and that $\overrightarrow{QP} = \overrightarrow{RS}$:

$\overrightarrow{PS} = \overrightarrow{PR} + \overrightarrow{RS} = (6\mathbf{a} - \mathbf{b}) + (-3\mathbf{a}) = 3\mathbf{a} - \mathbf{b} = \overrightarrow{QR}$, as required, and

$\overrightarrow{QP} = \overrightarrow{QR} + \overrightarrow{RP} = \overrightarrow{QR} + \left(-\overrightarrow{PR}\right) = (3\mathbf{a} - \mathbf{b}) + (-6\mathbf{a} + \mathbf{b}) = -3\mathbf{a} = \overrightarrow{RS}$,

as required.