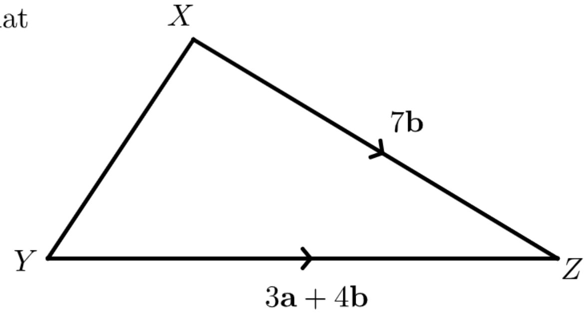
Question 1

Q is the point on XY such that
$\overrightarrow{XY} = 6\overrightarrow{QY}$

Find the vector $\overrightarrow{ZQ}$
in terms of $\mathbf{a}$ and $\mathbf{b}$.



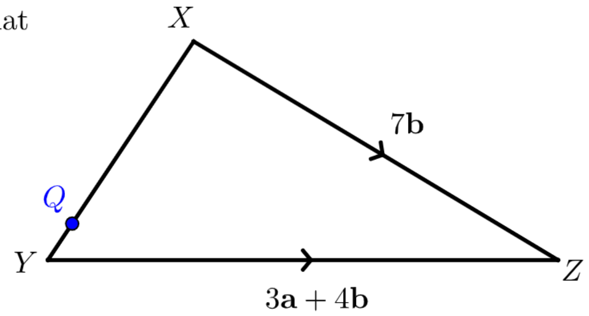
Question 2

n is a positive integer.
Show that $5n^2 + 44 - (n-4)^2$ is always even.

Question 1

Q is the point on XY such that $\overrightarrow{XY} = 6\overrightarrow{QY}$

Find the vector $\overrightarrow{ZQ}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.



First note that $\overrightarrow{XQ} = \frac{5}{6}\overrightarrow{XY}$.

$$\overrightarrow{XY} = \overrightarrow{XZ} + \overrightarrow{ZY}$$
$$= \overrightarrow{XZ} + \left(-\overrightarrow{YZ}\right) = (7\mathbf{b}) + (-3\mathbf{a} - 4\mathbf{b}) = -3\mathbf{a} + 3\mathbf{b}$$

So $\overrightarrow{XQ} = \frac{5}{6}(-3\mathbf{a} + 3\mathbf{b}) = -\frac{5}{2}\mathbf{a} + \frac{5}{2}\mathbf{b}$

Now, $\overrightarrow{ZQ} = \overrightarrow{ZX} + \overrightarrow{XQ}$

$$= -\overrightarrow{XZ} + \overrightarrow{XQ} = (-7\mathbf{b}) + \left(-\frac{5}{2}\mathbf{a} + \frac{5}{2}\mathbf{b}\right) = -\frac{5}{2}\mathbf{a} - \frac{9}{2}\mathbf{b}$$

Question 2

n is a positive integer.
Show that $5n^2 + 44 - (n-4)^2$ is always even.

Expanding and simplifying, we get $4n^2 + 8n + 28$
We can write this as $2(2n^2 + 4n + 14)$
This is always even.