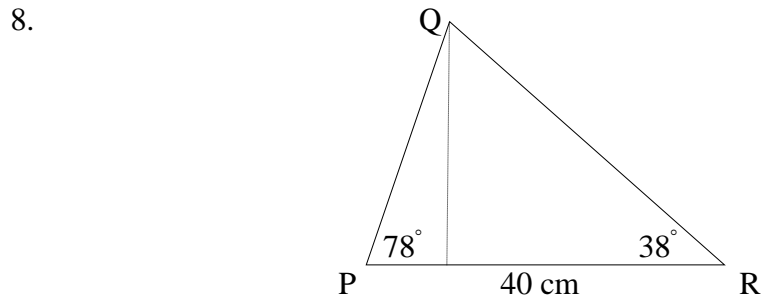


1. (a) Given that $\mathbf{r} = \begin{pmatrix} \\ -4 \end{pmatrix}$ and $\mathbf{s} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$,
- Write down the components of $2\mathbf{r} - 3\mathbf{s}$
 - Find $|2\mathbf{r} - 3\mathbf{s}|$.
- (b) PQRST is a pentagon. TS is parallel to QR and $TS = 2QR$.
RS is parallel to PT and $RS = 2PT$.

Given that $\overrightarrow{PT} = \mathbf{u}$ and $\overrightarrow{QR} = \mathbf{v}$,

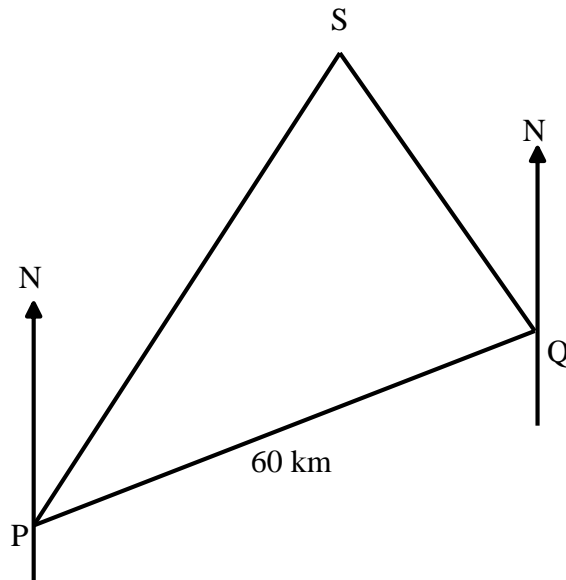
- Find, in terms of \mathbf{u} and/or \mathbf{v} ,
 - \overrightarrow{TS}
 - \overrightarrow{QS}
 - \overrightarrow{PQ}
 - Use vectors \mathbf{u} and \mathbf{v} to find the relationship between the line segments PQ and TR.
2. The population of a town is 53000 and is estimated to be increasing at the rate of 3% p.a.
After how many years will the population exceed 60000? Show working.
3. Calculate the volume of the largest cone which can be placed inside a cube which has edges of length 10 cm. The base of the cone sits on the base of the cube.
4. The population of Aytoon is 48000 and increasing at 2.4% p.a.
The population of Beeton is 60000 and decreasing at 4.6% p.a.
In how many years will the population of Aytoon exceed the population of Beeton?
5. (a) Show that $\frac{2\sin^2 x^\circ}{1 - \sin^2 x^\circ} = 2\tan^2 x^\circ$.
- (b) Show that $(\cos x^\circ + \sin x^\circ)^2 - 2\cos x^\circ \sin x^\circ = 1$.
- (c) Show that $\cos^3 x^\circ + \cos x^\circ \sin^2 x^\circ = \cos x^\circ$.
6. Factorise:
- $4x^2 - 25y^2$
 - $2x^2 - 7x + 3$
 - $1 + x - 2x^2$
 - $x - x^3$

7. (a) Simplify $6y^{\frac{5}{2}} \div 3y^{\frac{1}{2}}$.
 (b) Change the subject of the formula $y = 5t + 3w$ to w .
 (c) Solve $2x^2 + 3x - 1 = 0$, giving your answers correct to 1 decimal place.
 (d) Simplify as far as possible $\sqrt{3}(\sqrt{6} - \sqrt{3})$.
 (e) Express $\sqrt{\frac{3}{24}}$ with a rational denominator.



Find the length of the altitude from Q.

9. Two oil platforms in the North Sea are 60km apart.



Platform P is on a bearing of 225° from platform Q.

A ship S is on a bearing of 020° from platform P and 330° from platform Q.
 How far is the ship from platform Q?

10. (a) Express $b^{-\frac{1}{2}} 3b + b^{\frac{1}{2}}$ without brackets in its simplest form.
 (b) Find the value of this expression when $b = 8$, leaving your answer as a surd in its simplest form.