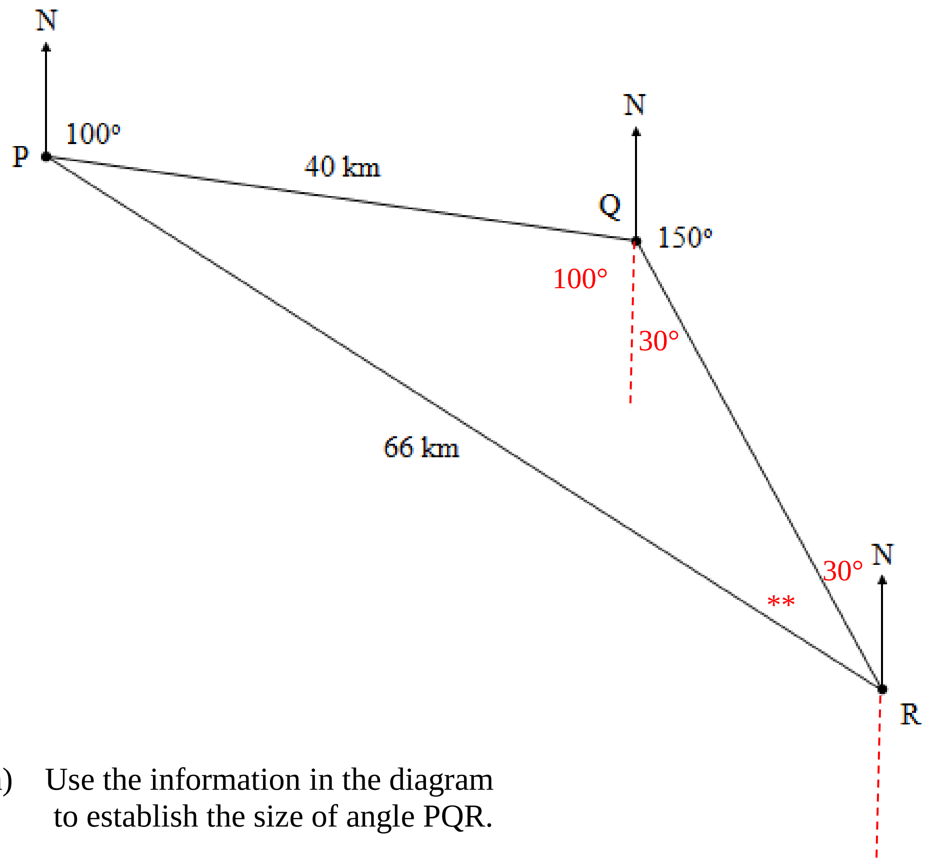
Banker Questions 2 - solutions

1.



(a) Use the information in the diagram to establish the size of angle PQR.

Angle at Q (left) is alternate to angle at P = 100°
Angle at Q (right) is 30° (180 – 150°)
So Angle PQR = 130°

(b) Hence find the bearing of mast P from mast R.

Top angle at R is 30° (alternate to angle at Q)

To find bearing of P from R – we need angle marked **

Use sine rule: $\frac{\sin R}{r} = \frac{\sin Q}{q}$

$$\frac{\sin R}{40} = \frac{\sin 130}{66}$$

Cross multiply: sin R = 40 sin 130 / 66 R = 27.7°

Hence bearing of P from R is 360 – (30 + 27.7) = 302.3°

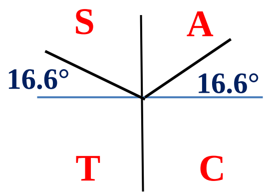
2. Solve the equation

$$7\sin x^{\circ} - 2 = 0, \quad \text{for} \quad 0 \leq x < 360.$$

Re-arrange to basic form: 7 sin x = 2 sin x = 2/7

Acute x = 16.6°

Now use ASTC



Sin x > 0 (positive)

So quadrants 1 and 2

Hence: x = 16.6° or x = 180 – 16.6 = 163.4°

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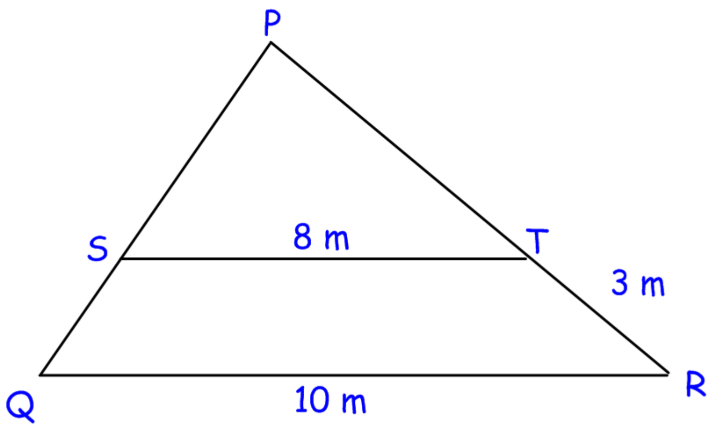
3. The diagram shows part of the roof of an aircraft hangar.

ST is parallel to QR.

Calculate the length of the spar PT.



3 RE

Triangles are similar. We want PT. Look for ratios of corresponding sides.

$\frac{PT}{PR} = \frac{8}{10}$ Now let PT = x. So, PR = x + 3 Hence $\frac{x}{x+3} = \frac{8}{10}$

Cross multiply: 10 x = 8(x + 3) 10x = 8x + 24 2x = 24 x = 12

So PT = 12 metres.

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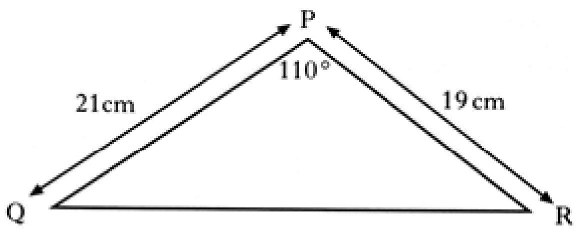
4. Calculate the area of the triangle PQR.



Use formula: Area = ½ a b sin C Hence Area = ½ x 21 x 19 x sin 110° = 187.5 cm^2.

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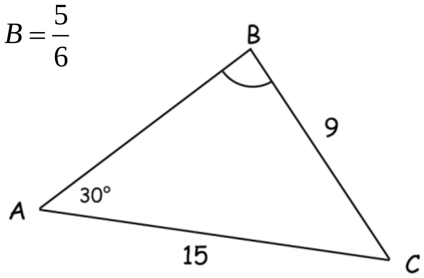
5. In triangle ABC show that $\sin B = \frac{5}{6}$



Use sine rule: $\frac{\sin B}{b} = \frac{\sin A}{a}$

Hence $\frac{\sin B}{15} = \frac{\sin 30}{9}$ now cross multiply: sin B = 15 sin 30 / 9

But sin 30 = ½ (Exact value table)

Hence $\sin B = \frac{15 \times 0.5}{9} \quad \rightarrow \quad \sin B = \frac{7.5}{9} = \frac{15}{18} = \frac{5}{6}$

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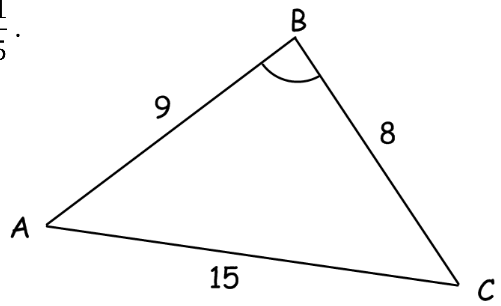
6. In triangle ABC show that $\cos A = \frac{121}{135}$.



Use cosine rule

$$cosA = \frac{b^2 + c^2 - a^2}{2bc} \quad \rightarrow \quad \cos A = \frac{15^2 + 9^2 - 8^2}{2 \times 15 \times 9} = \frac{242}{270} = \frac{121}{135}$$

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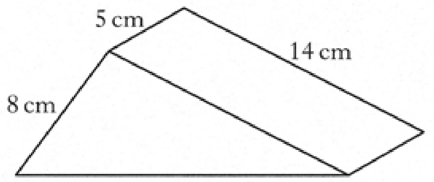
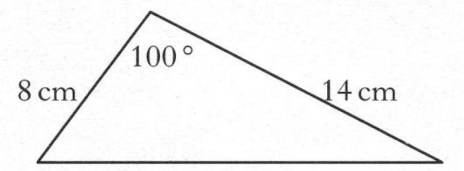
7. A metal doorstop is prism shaped,

as shown in Figure 1 *Figure 1.*



The uniform cross-section

as shown in Figure 2: *Figure 2.*



Find the volume of metal required to make the doorstop.

Area of cross section = ½ a b sin C = ½ x 8 x 14 x sin 100° = 55.15 cm^2

Volume of prism = A x L = 55.15 x 5 = 275.75 cm^3

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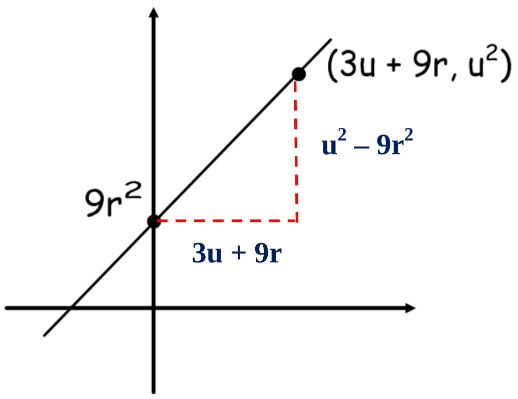
8. A line passes through the point $(0, 9r^2)$ and $(3u + 9r, u^2)$ as shown in the diagram.



a) Find an expression for the gradient of this line in its simplest form.

Gradient m = rise / run

$$m = \frac{u^2-9r^2}{3u+9r} \quad \rightarrow \quad \frac{(u+3r)(u-3r)}{3(u+3r)} \quad \rightarrow \quad \frac{(u-3r)}{3}$$

In the above we used the difference of 2 squares on the top and common factor on bottom

And then cancelled (u + 3r)

NB next part should have read u = 4 (not u = 3)

b) Find the equation of the line when $r = 1$ and $u = 4$ and give your answer with integer coefficients.

Using gradient found above; put u = 4 and r = 1 in it and we get m = 1/3

Now use y = mx + c. We can see that $c = 9r^2$ which when r = 1 gives c = 9

So $y = \frac{1}{3}x + 9$ To get integer (whole number) coefficients,

multiply throughout by 3 **3y = x + 27**
