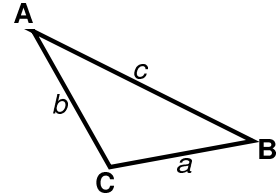


Trigonometry

Simple triangles - Ex 1

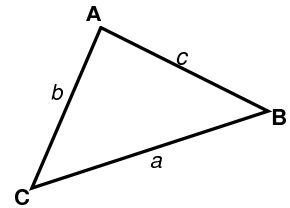
The following questions require the determination of one or more values of sides, angles, height, etc for the triangles shown in the diagram opposite the questions concerned.

1. In the triangle shown, the lengths of the sides are $a = 200\text{mm}$, $b = 250\text{mm}$ and $c = 350\text{mm}$. Calculate the angle at A.



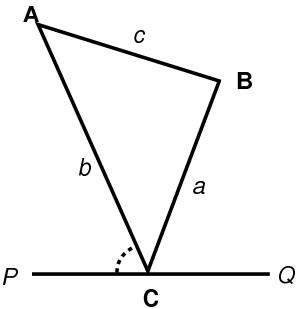
2. If the side AB is laid horizontally so that C is some distance above it, what is that distance?

3. In the triangle ABC the angle at A is 80° and the sides b and c are 75cm and 65cm respectively. How long is the side a ?



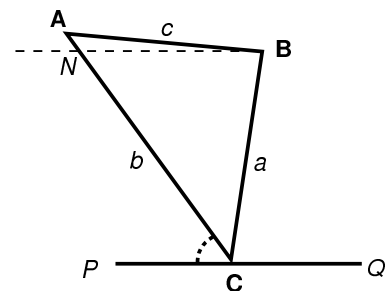
4. Calculate the angles at B and C to the nearest degree using the values given in the preceding question for the other sides and angle.

5. Given the triangle resting on the point C is positioned so that the angle PCA is 70° and that the sides a , b and c are 50mm , 75mm and 50mm respectively, determine how high the point B is from the plane indicated by PQ.



6. If the triangle is made out of a uniform sheet of metal, will it fall over under the influence of gravity? (*Hint:* This requires determining the Centre of gravity which is the point where all of the median lines intersect!). What would the angle PCA have to be for the triangle to balance on its point C - assuming no slippage or lateral force?

7. The illustration opposite shows a slightly different positioning of the triangle in the figure used for exercises 6 and 7 - the angle PCA is 55° this time. Otherwise the dimensions of the triangle are the same. If a cut BN, parallel to PQ is to be made across the upper portion of the triangle, where on AC is the point N?



8. Assuming that the triangle is a uniform sheet of metal, calculate the relative weights of the triangle ANB and PCN.

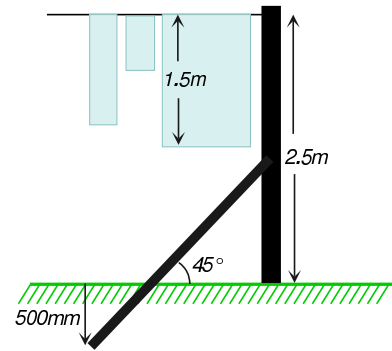
9. Given the relative weights calculated in Q8, assume that the smaller triangle is hanging from B using a (relatively) weightless string. What should the angle PCA be for the combination to rest in equilibrium on the point C?

10. Redraw the figure so that the larger triangle is now resting on point N (ie rotating it some suitable anti-clockwise angle).

a. What would the angle PNB have to be if the triangle BNC is to rest in equilibrium without the small triangle hanging on B?

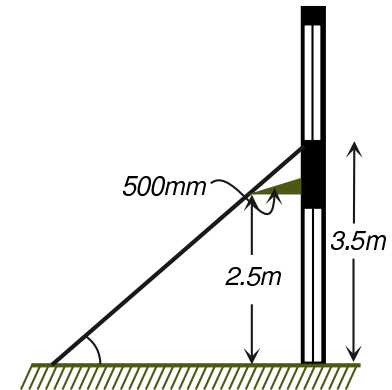
b. If the triangle ABN is re-attached to B, what would the angle PNB have to be for the combination to rest in equilibrium?

11. The washing line in your garden is supported by a pole 2.5m high. Because of the high winds where you live you need to support the pole using sloping support struts as shown in the diagram. If the washing can hang down at most 1.5m how long must a support sloping at 45° be made?



12. If the direction of the wind is pretty constant you will only need one support - but if not, you might need three disposed at 120° around the pole. With three of them you decide you will need to bury the bottom end 500mm below the surface of the lawn. How long must the three supports be altogether? Can you get the three supports out of two 2.5m wooden beams?

13. You need a ladder to clean the upstairs window over your front door. The drawing shows that the bottom of the window is just over 3.5m above ground level. You have, outside the front door on the wall a porch roof which sticks out 500mm from the wall at a height of 2.5m. What is the maximum angle which the ladder can make with the horizontal?

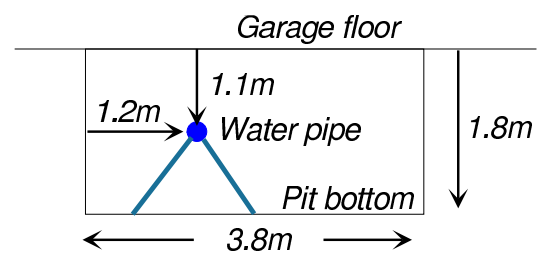


14. What is the minimum length of the ladder to lie as shown in the figure?

15. If the minimum angle of the ladder to avoid slippage is 60° to the horizontal, will you have to rest the ladder above the window which is just under 2m high, rather than below it? What will be the angle which the ladder makes to the horizontal in these circumstances?

16. If the ladder is resting above the window as indicated in the previous question, what must be its minimum length?

17. You are a keen car buff and would like to have your own garage pit for under car maintenance. You need, therefore to dig under your current garage floor and put in re-inforced concrete walls and bottom to your pit.



When you are digging you come across a mains water pipe which you cannot avoid - as shown in the diagram. In order to properly support this (which, fortunately isn't going to be too much of a nuisance), you decide to put in extra reinforcing rods in the directions shown by the angled supports - ie making an equilateral triangle with the floor. How long do these rods have to be?

18. You ask a plumber friend to re-route the water pipe down to the floor of the pit, along it and up to the other side again. If the width of the pit is 1.2m how much pipe will he need?

19. After re-routing the pipe your plumber friend suggests that you put all your re-inforcing rods on the wall in the directions indicated in Q17. If your re-inforcing rods are at 100mm intervals in both directions, what total length of rod will you need?

20. If the depth of concrete is to be 75mm and the measurements shown are the finished internal dimensions of your pit, what volume (in cubic metres) of concrete will you need to order?