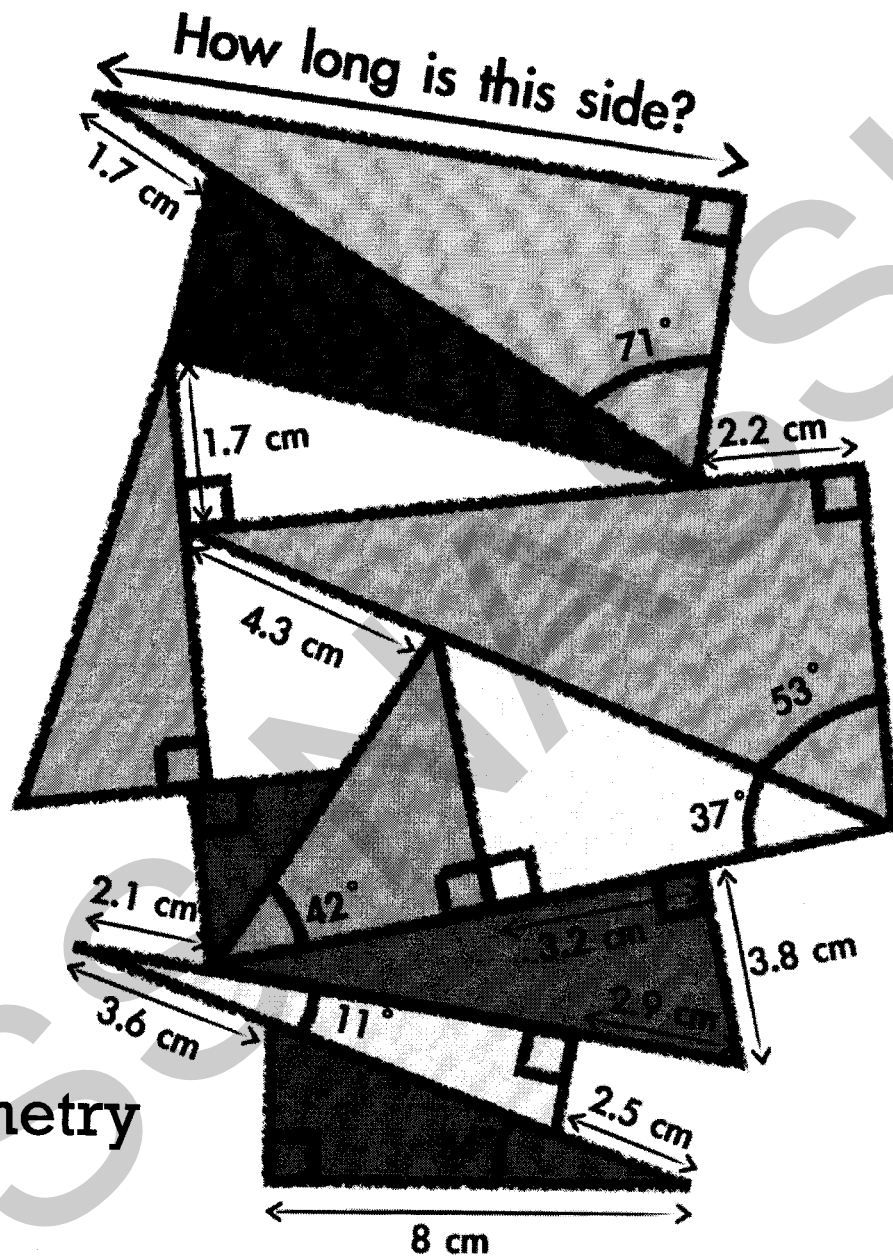


Secondary 4

Trigonometry Pile Up!



Trigonometry

Sine Law

Area of Triangles

Metric Relations

Ms. Nassif

TRIGONOMETRY

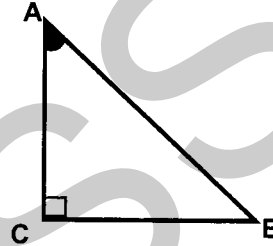
TERM 3

Trigonometry is used to find an _____ or the _____ of a triangle when Pythagorean Theorem is not helpful.

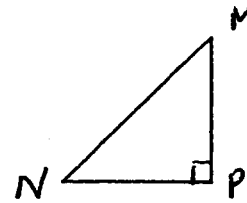
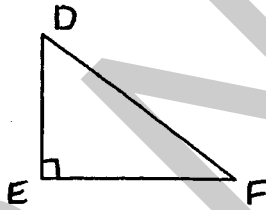
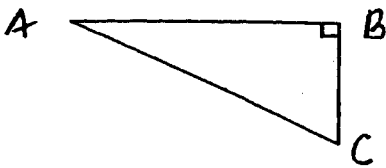
AB is the side across from the right angle which is called the _____.

BC is the side _____ to marked angle A

AC is the side _____ to the marked angle A

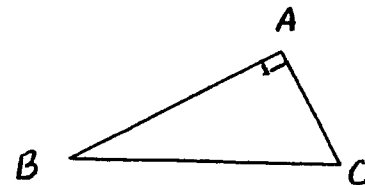
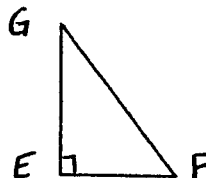
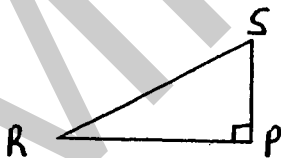


Exercise: In the given triangles, identify the following:



1. Side opposite to angle A
2. Side adjacent to angle A
3. Side opposite of angle F
4. Side adjacent to angle F
5. Side opposite to angle M
6. Side adjacent to angle M

Exercise: In the given triangle, name each of the following:



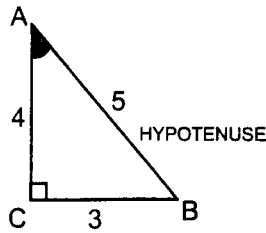
1. The hypotenuse for triangle GEF
2. The side opposite to angle R
3. The side adjacent to angle G
4. The side opposite to angle C
5. The side adjacent to angle S
6. The side opposite to angle F
7. The side adjacent to angle B

TRIGONOMETRIC RATIOS

Sine ()

Cosine ()

Tangent ()



$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$

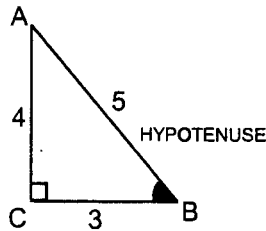
$$\tan A = \frac{\text{opposite}}{\text{adjacent}}$$

= _____

= _____

= _____

For the $\angle B$, the adjacent side measures 3 units and the opposite side measures 4 units.



$$\sin B = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos B = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan B = \frac{\text{opposite}}{\text{adjacent}}$$

= _____

= _____

= _____

NOTE: $\sin A = \frac{3}{5} = \cos B$ and $\cos A = \frac{4}{5} = \sin B$

- These ratios must be used in a _____ triangle only
- Opposite the angle A we find _____ opposite the angle B we find _____ and opposite to angle C we find _____
- Always keep _____ decimal places when calculating ex: $\sin 20 = 0.3420$
- Keep _____ decimal places in your final answer

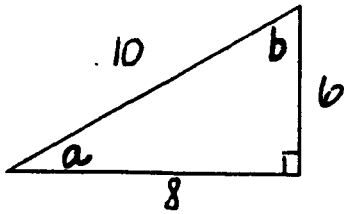
Trick:

Remember:

- Capital letter are used to name the _____ and lower cased letters are used to name the _____

Write out the Sine, Cosine, Tangent ratio for the angles labeled **a** and **b**. Leave as a fraction.

1)



Sin a = _____

Sin b = _____

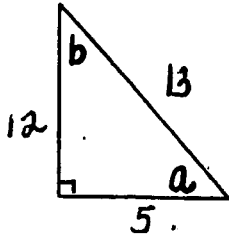
Cos a = _____

Cos b = _____

Tan a = _____

Tan b = _____

2)



Sin a = _____

Sin b = _____

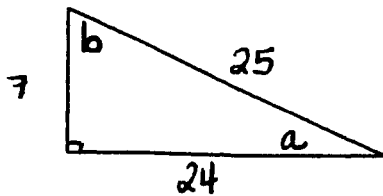
Cos a = _____

Cos b = _____

Tan a = _____

Tan b = _____

3)



Sin a = _____

Sin b = _____

Cos a = _____

Cos b = _____

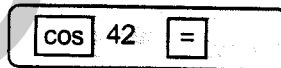
Tan a = _____

Tan b = _____

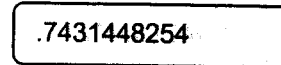
Use your calculator to get each of the trigonometric ratios in decimal form:
 Careful: Calculator must be in degrees (DEG or D) which should be written at the top of the screen.

ex: Find $\cos 42^\circ$

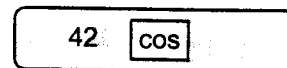
Enter: Calculator Type 1



Display:



Calculator Type 2



1) Sin 20 =

2) Sin 72 =

3) Sin 24 =

4) Cos 37 =

5) Cos 63 =

6) Cos 46 =

7) Tan 80 =

8) Cos 1 =

9) Tan 37 =

10) Sin 65 =

11) Tan 18 =

12) Tan 52 =

13) Tan 89 =

14) Sin 17 =

15) Tan 45 =

16) Cos 84 =

17) Sin 54 =

18) Tan 23 =

19) Sin 54 =

20) Tan 89 =

21) Cos 14 =

22) Sin 43 =

23) Cos 98 =

24) Tan 55 =

25) Sin 44 =

26) Cos 89 =

27) Tan 90 =

28) Sin 90 =

29) Cos 90 =

30) Sin 12 =

Backwards SOHCAHTOA

CALCULATOR TYPE 1

1. Press INV or 2ND button
2. Press **SIN**, **COS** or **TAN**
3. Enter the value of the ratio
4. Press equal/enter to get the value

Round the resulting angle to the required number of decimal places.

CALCULATOR TYPE 2 (older style)

1. Enter the value of the ratio
2. Press INV or 2ND button
3. Press **SIN**, **COS** or **TAN**

Note: the equals sign is not needed.

27.1 | 2929446

Find the value of the angles.

- | | | |
|------------------------|------------------------|-----------------------|
| 31) $\sin A = 3/5$ | 41) $\cos E = 510/513$ | 51) $\tan C = 14/11$ |
| 32) $\cos B = 4/7$ | 42) $\tan F = 15/310$ | 52) $\sin D = 17/20$ |
| 33) $\tan C = 62/54$ | 43) $\sin A = 2/5$ | 53) $\cos E = 7/10$ |
| 34) $\sin D = 43/44$ | 44) $\cos B = 4/9$ | 54) $\tan F = 96/56$ |
| 35) $\cos E = 10/13$ | 45) $\tan C = 5/4$ | 55) $\tan C = 59/49$ |
| 36) $\tan F = 45/30$ | 46) $\sin D = 9/11$ | 56) $\sin D = 69/110$ |
| 37) $\sin A = 30/50$ | 47) $\cos E = 5/9$ | 57) $\cos E = 1/6$ |
| 38) $\cos B = 48/78$ | 48) $\tan F = 11/9$ | 58) $\tan F = 56/45$ |
| 39) $\tan C = 625/545$ | 49) $\sin A = 8/11$ | 59) $\sin A = 56/60$ |
| 40) $\sin D = 436/446$ | 50) $\cos B = 1/3$ | 60) $\cos B = 2/5$ |

FIND THE VALUE OF THE ANGLES.

- | | | |
|-----------------------|-----------------------|-----------------------|
| 1. $\sin A = 0.7445$ | 11. $\tan B = 1.2799$ | 21. $\sin D = 0.8$ |
| 2. $\tan A = 3.4874$ | 12. $\cos C = 0.1908$ | 22. $\cos E = 0.9350$ |
| 3. $\tan B = 0.3249$ | 13. $\tan D = 0.4452$ | 23. $\tan F = 8$ |
| 4. $\cos A = 0.7071$ | 14. $\cos E = 0.5299$ | 24. $\sin G = 0.9336$ |
| 5. $\cos B = 0.7880$ | 15. $\sin F = 0.9063$ | 25. $\cos H = 0.3584$ |
| 6. $\sin C = 0.0891$ | 16. $\cos G = 0.7193$ | 26. $\sin I = 0.8949$ |
| 7. $\cos A = 0.2981$ | 17. $\tan H = 6.3138$ | 27. $\cos J = 0.9252$ |
| 8. $\sin B = 0.8544$ | 18. $\cos A = 0.9511$ | 28. $\cos A = 1$ |
| 9. $\tan C = 1$ | 19. $\sin B = 0.9511$ | 29. $\tan B = 1$ |
| 10. $\sin A = 0.6681$ | 20. $\tan C = 3.2704$ | 30. $\sin C = 0.77$ |

Calculator:

$20 \sin (20 \div 30) =$

SOLVE :

I) Find the angle :

1. $\sin A = \frac{20}{30}$

2. $\sin B = \frac{4}{5}$

3. $\cos A = \frac{19}{40}$

4. $\tan D = \frac{3}{7}$

5. $\sin E = \frac{12}{35}$

6. $\cos F = \frac{14}{20}$

7. $\tan G = \frac{61}{80}$

8. $\sin H = \frac{80}{96}$

II) Find the value of the side length ("x"); when "x" is on top

1. $\cos 30^\circ = \frac{x}{80}$

2. $\sin 25^\circ = \frac{x}{70}$

3. $\tan 60^\circ = \frac{x}{12}$

4. $\sin 75^\circ = \frac{x}{70}$

5. $\cos 85^\circ = \frac{x}{60}$

6. $\tan 72^\circ = \frac{x}{45}$

III) Find the value of the side lengths ("x"); when "x" is on the bottom

1. $\cos 30^\circ = \frac{80}{x}$

2. $\sin 25^\circ = \frac{70}{x}$

3. $\tan 60^\circ = \frac{12}{x}$

4. $\sin 75^\circ = \frac{70}{x}$

5. $\cos 85^\circ = \frac{60}{x}$

6. $\tan 72^\circ = \frac{45}{x}$

7. $\cos 89^\circ = \frac{39}{x}$

IV) A mixed bag: Find the value of "x"

1. $\cos 60^\circ = \frac{x}{20}$

2. $\sin A = \frac{25}{60}$

3. $\tan 82^\circ = \frac{5}{x}$

4. $\sin A = \frac{7}{9}$

5. $\tan 42^\circ = \frac{x}{72}$

6. $\cos 31^\circ = \frac{14}{x}$

7. $\sin 50^\circ = \frac{x}{42}$

8. $\cos A = \frac{39}{78}$

Calculator:

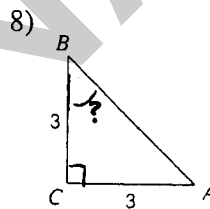
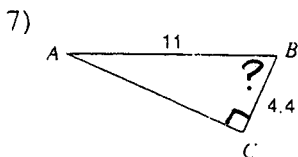
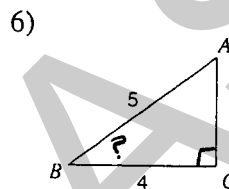
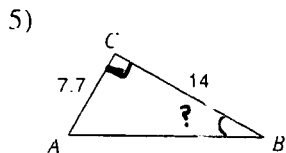
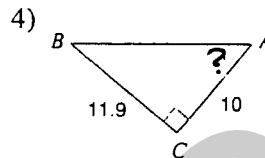
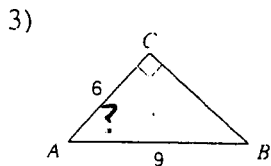
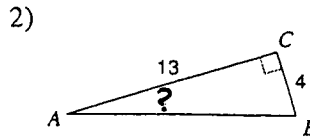
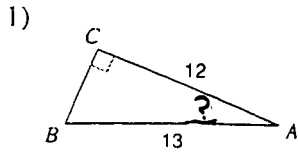
$80 \times \cos 30^\circ =$

Calculator:

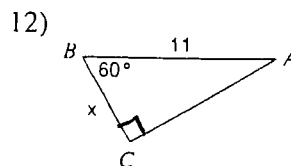
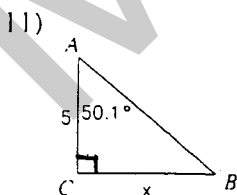
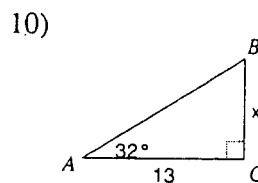
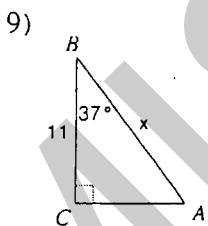
$80 \div \cos 30^\circ =$

Trigonometry Practice

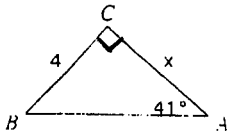
Find the measure of each angle indicated.



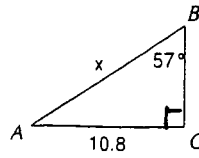
Find the measure of each side indicated.



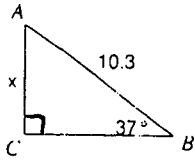
13)



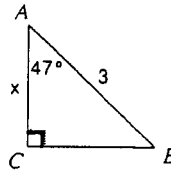
14)



15)

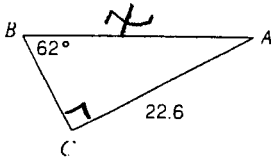


16)

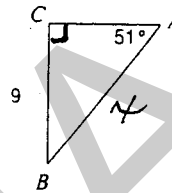


Find the value of x or y in each triangle.

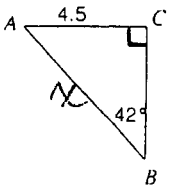
17)



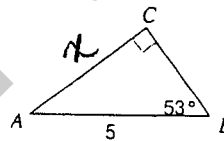
18)



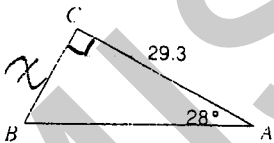
19)



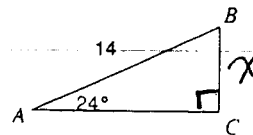
20)



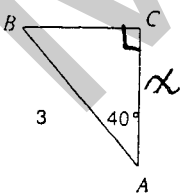
21)



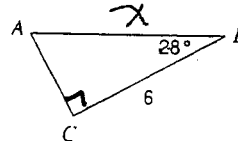
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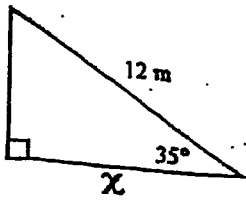
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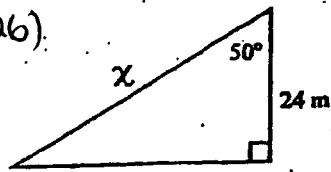
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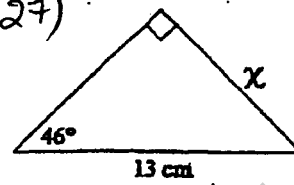
25)



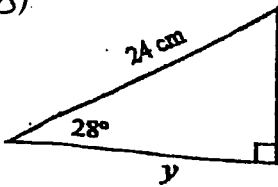
26)



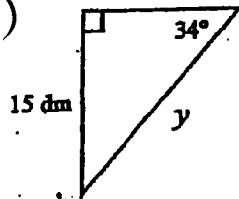
27)



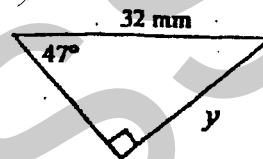
28)



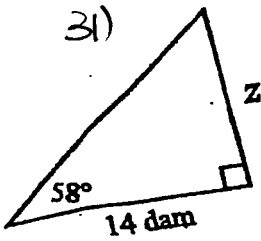
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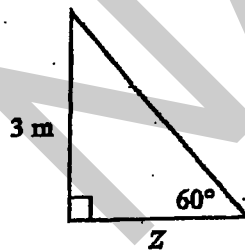
30)



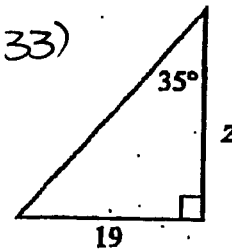
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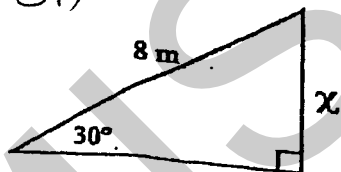
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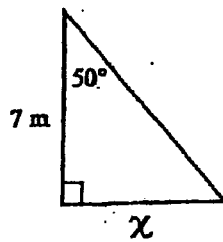
33)



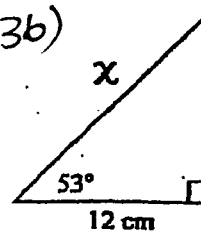
34)



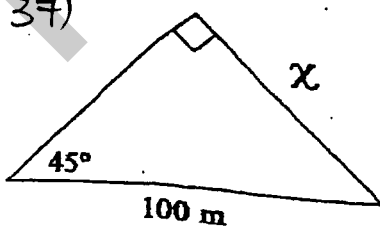
35)



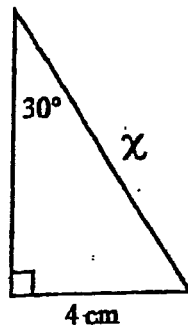
36)



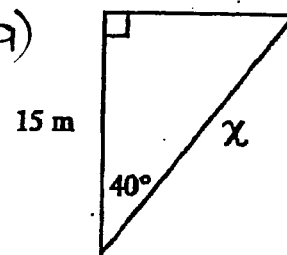
37)



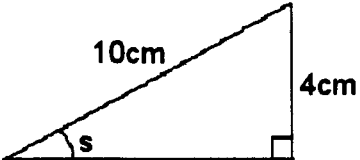
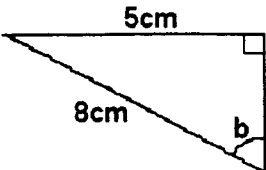
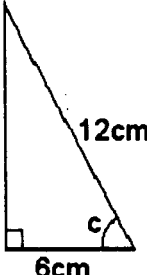
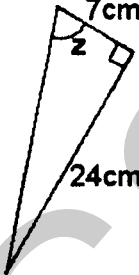
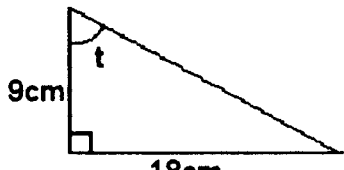
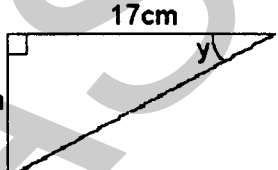
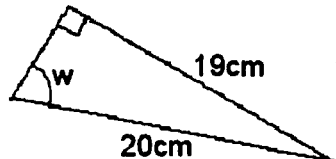
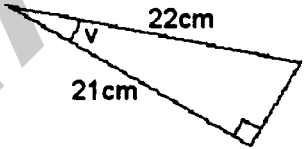
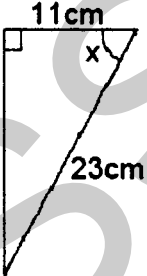

38)



39)

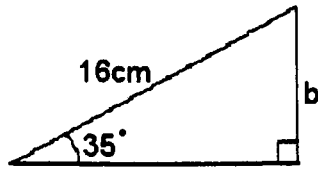


SOLVE FOR THE VARIABLE

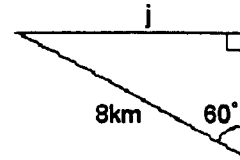
1. 	6. 
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SOLVE FOR THE VARIABLE

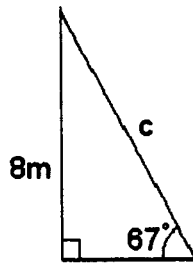
1.



7.



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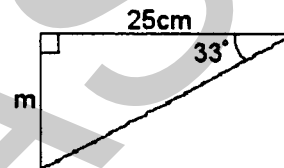
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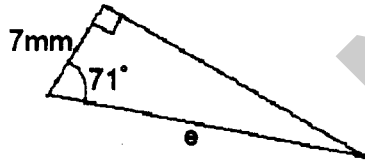
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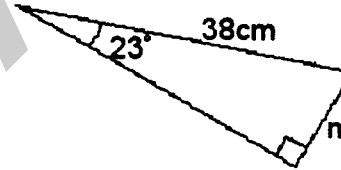
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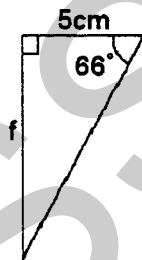
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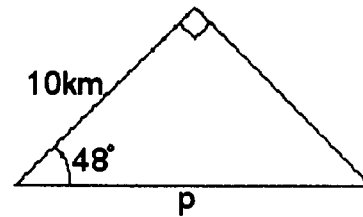
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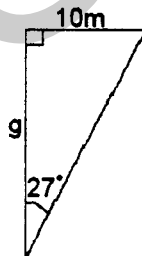
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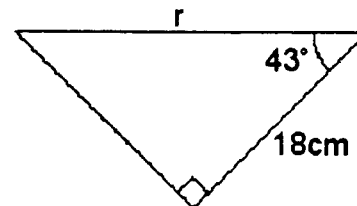
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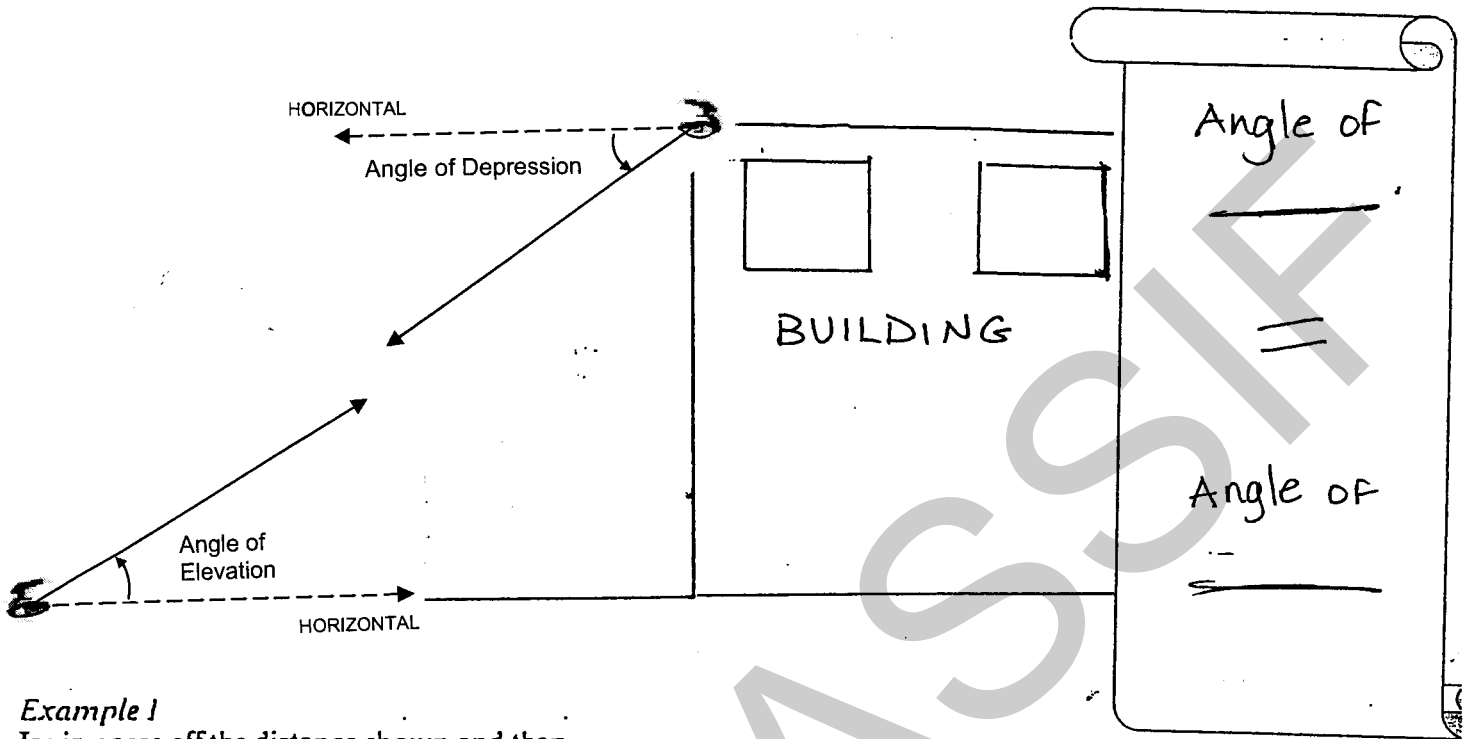
6.



12.

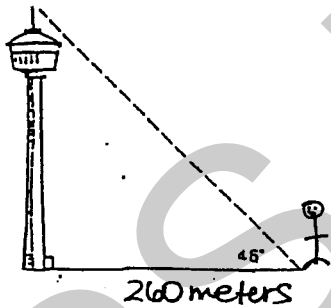


Angle of Elevation & Depression



Example 1

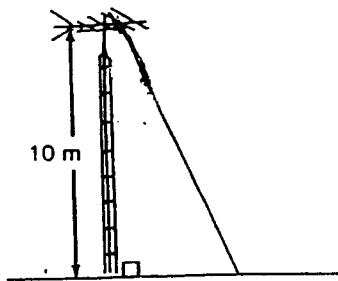
Janis paces off the distance shown and then determines that the angle of elevation to the Calgary Tower from a point on the ground is 46° . What is the height of the tower?



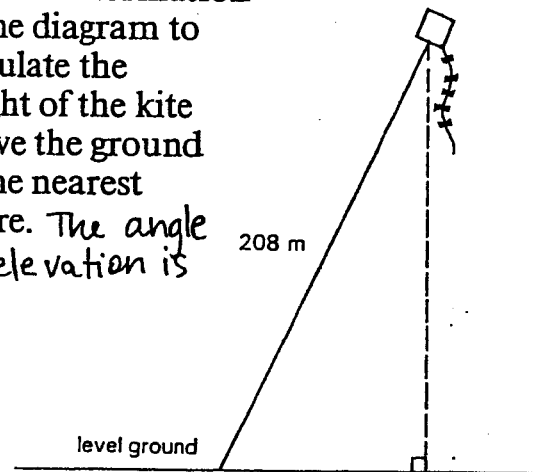
EXERCISES

1. A support wire is fastened to a TV antenna as shown. How long is the support wire?

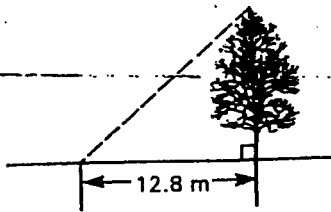
The angle of depression is 65°



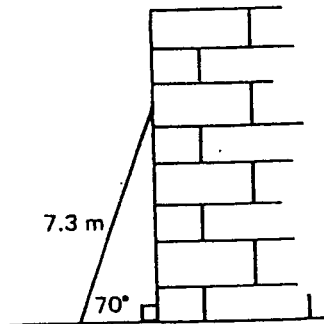
2. Use the information in the diagram to calculate the height of the kite above the ground to the nearest metre. The angle of elevation is 64° .



3. Use the information in the diagram to calculate the height of the tree to one decimal place, if the angle of elevation is 41° .



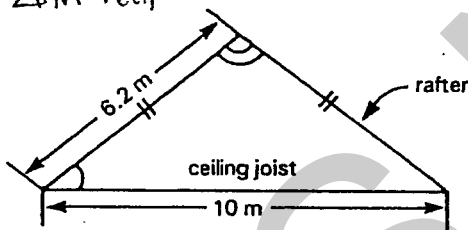
4. (a) How far up the wall does the ladder reach?



- (b) Calculate the distance from the foot of the ladder to the base of the wall.

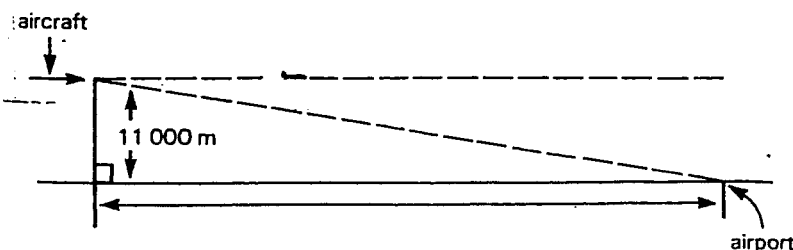
7. A cottage roof has the dimensions shown in the diagram.

Hint: split Δ in half

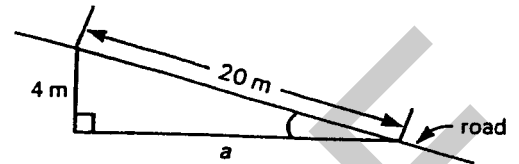


- (a) Determine the angle between the rafter and the ceiling joist.
 (b) Determine the angle at the peak of the roof.

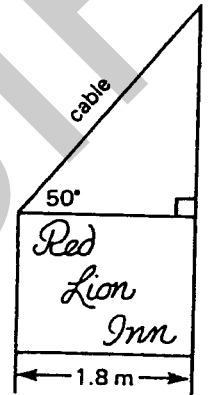
9. An aircraft is flying at an altitude of 11 000 m above ground level. At what horizontal distance from the airport should it begin its descent to maintain an angle of depression of 9° ?



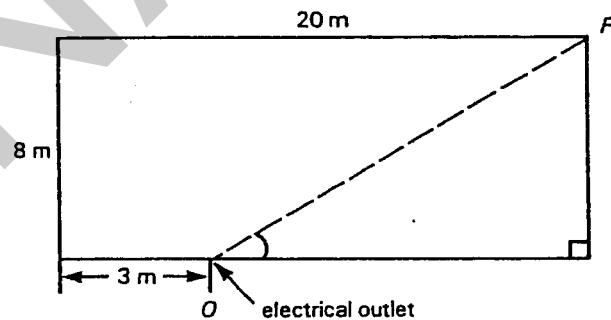
5. A road drops 4 m in elevation every 20 m. What angle does the road make with the horizontal distance a in the diagram?



6. A sign that is 1.8 m wide is supported by a cable as shown. How long is the cable?



8. A rectangular lawn has the dimensions shown in the diagram. The lawn is cut with an electric mower and the electrical outlet is located as shown.



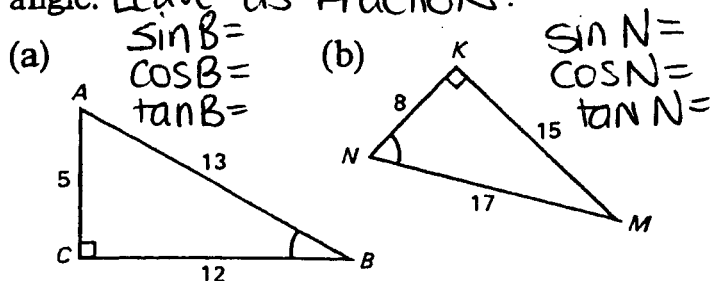
- (a) Calculate the indicated angle at the outlet to the nearest degree.
 (b) Use your answer from part (a) to determine the length of cord needed to reach from the outlet (O) to the far corner (F) of the lawn.

10. A rectangular sheet of notepaper has the dimensions $21.6 \text{ cm} \times 27.8 \text{ cm}$.

- (a) Determine the angle that a diagonal makes with each of the sheet's edges.
 (b) Calculate the angles formed at the intersection of the two diagonals.

CHAPTER REVIEW

1. Determine the three trigonometric ratios for the marked angle in each triangle. Leave as fraction.



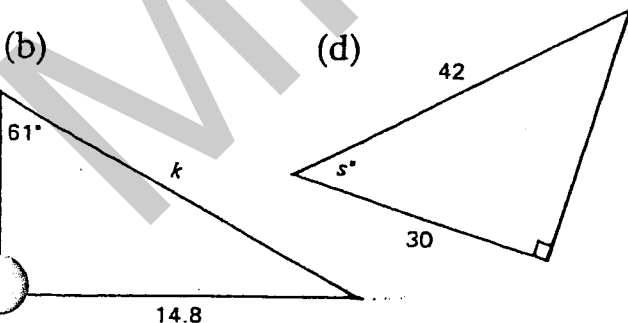
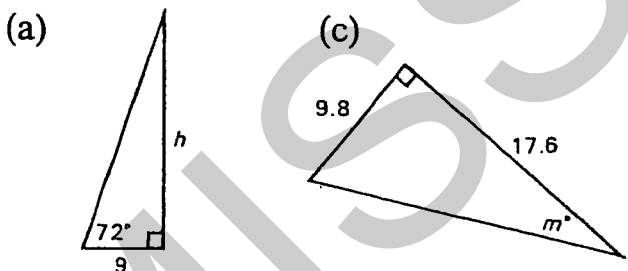
2. Evaluate each ratio using a calculator or the table on page 175. Give your answers to four decimal places.

- (a) $\tan 18^\circ$ (d) $\sin 8^\circ$ (g) $\cos 28^\circ$
 (b) $\sin 73^\circ$ (e) $\cos 65^\circ$ (h) $\tan 56^\circ$
 (c) $\cos 2^\circ$ (f) $\tan 83^\circ$ (i) $\sin 47^\circ$

3. Determine the measure of each angle to the nearest degree.

- (a) $\cos A = 0.9816$ (e) $\sin E = 0.9135$
 (b) $\sin B = 0.7880$ (f) $\tan F = 0.8391$
 (c) $\cos C = 0.2588$ (g) $\cos G = 0.0349$
 (d) $\tan D = 0.3249$ (h) $\sin H = 0.4384$

4. Use trigonometric ratios to determine the value of each variable.



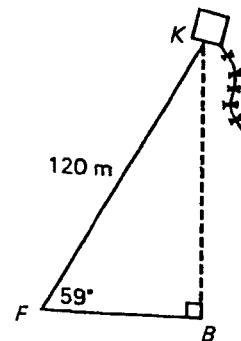
5. Evaluate without the use of a table or calculator.

- (a) $\sin 0^\circ$
 (b) $\cos 45^\circ$
 (c) $\tan 30^\circ$
 (d) $\sin 60^\circ$
 (e) $\cos 90^\circ$
 (f) $\tan 60^\circ$
 (g) $\sin 30^\circ$
 (h) $\sin 45^\circ$

6. Use trigonometry to determine the area of a regular decagon (a polygon with ten equal sides) if each side has a length of 22 cm.

7. Francine is flying a kite and has let out 120 m of string. The angle of elevation of the kite is 59° .

Give your answers to parts (a) and (b) to the nearest metre.



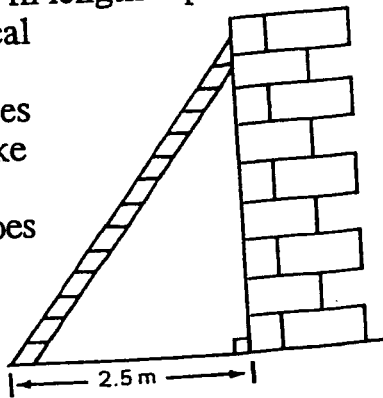
- (a) How high is the kite above the ground?
 (b) What is the horizontal distance from Francine to the point on the ground directly below the kite?

8. A train track rises 50 m over a horizontal distance of 1 km. What is the angle of elevation of the track to the nearest degree?

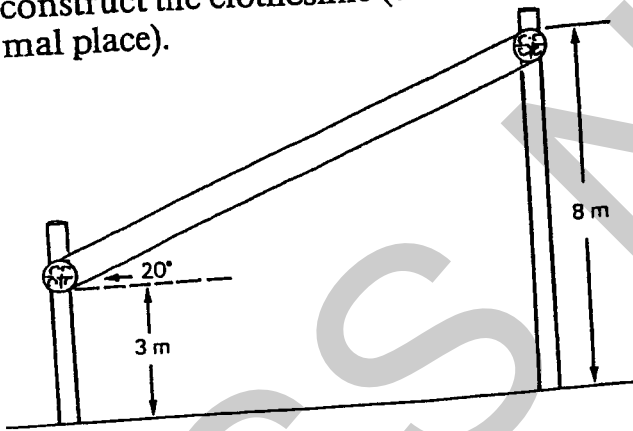
9. The angle of depression from a light aircraft to its landing strip is 12° . If the altitude of the aircraft above the landing strip is 1280 m, what is the horizontal distance from the aircraft to the landing strip?

10. A ladder 8.7 m in length is placed against a vertical wall as shown.

What angle does the ladder make with the wall?
What angle does it make with the ground?



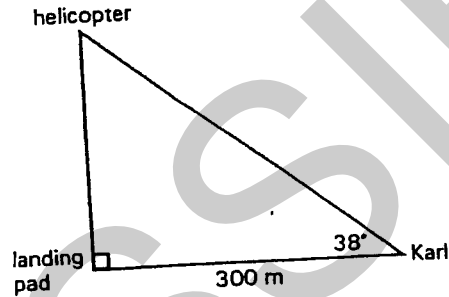
11. A clothesline is constructed by fastening a length of plastic-coated wire around two pulleys as shown in the diagram. Determine the length of wire needed to construct the clothesline (to one decimal place).



12. On a day with little wind, José ascends in a hot-air balloon. He measures the angle of depression to a landmark (800 m from a point directly below the balloon) to be 10° . One minute later the angle of depression to the same landmark is 18° . (Assume that the balloon does not move horizontally.)

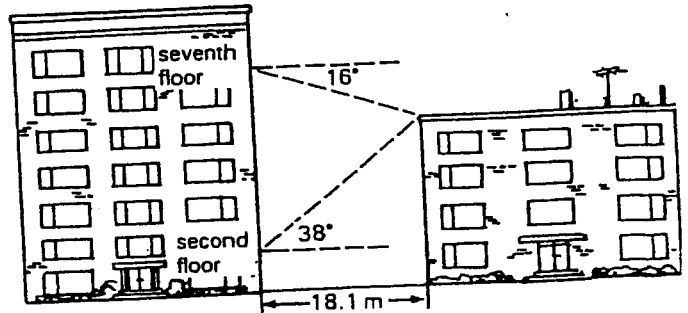
- (a) How fast is the balloon rising? Give your answer in metres per second to one decimal place.
- (b) What is José's height above the ground 5 min after he ascends? Give your answer to the nearest metre.

13. From an office-building window Karl sees a helicopter hovering over a landing pad on a hospital roof as shown in this diagram.

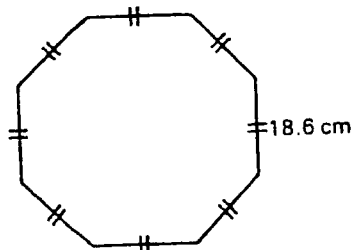


How high is the helicopter above the landing pad? (Assume that Karl's line of sight is at the same height as the landing pad.)

14) Angles are measured from the second- and seventh-floor windows of one apartment building to the top of another apartment building. In the diagram, what is the average height of one floor in the apartment building on the left? Give your answer to one decimal place.



15. Calculate the area of this regular octagon to the nearest square centimetre.



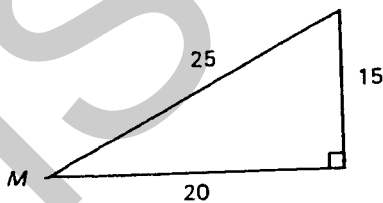
CHAPTER TEST

1. Determine whether each statement is true or false.

- All right-angled triangles are similar.
- The longest side in a right-angled triangle is called the hypotenuse.
- The values of the three ratios associated with an acute angle in a right-angled triangle are unique to that angle.
- Trigonometry can be used to indirectly determine the lengths of sides in right-angled triangles.
- Solving a triangle means finding all values for the variable that make the triangle true.
- The sine ratio is $\frac{\text{opposite}}{\text{adjacent}}$.
- $\cos 48^\circ = 0.6691$
- If $\tan K = 0.8290$, then $\angle K = 56^\circ$.
- $(\cos 20^\circ)^2 + (\cos 70^\circ)^2 = 1$
- Angle of elevation and angle of inclination are the same.

2. Distinguish between angle of elevation and angle of depression using a sketch.

3. Determine the three trigonometric ratios for $\triangle M$.



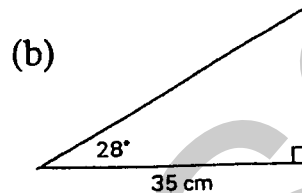
4. Evaluate using a table or a calculator.

- (a) $\sin 19^\circ$ (b) $\cos 84^\circ$ (c) $\tan 71^\circ$

5. Determine the measure of each angle to the nearest degree.

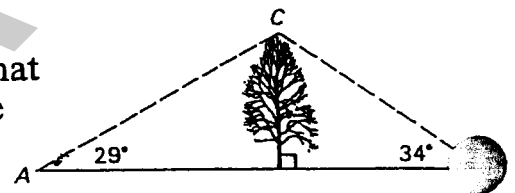
- (a) $\cos A = 0.8090$ (c) $\tan C = 0.4452$
 (b) $\sin B = 0.2924$ (d) $\cos D = 0.1564$

6. Use trigonometric ratios to determine the area of each triangle to one decimal place.

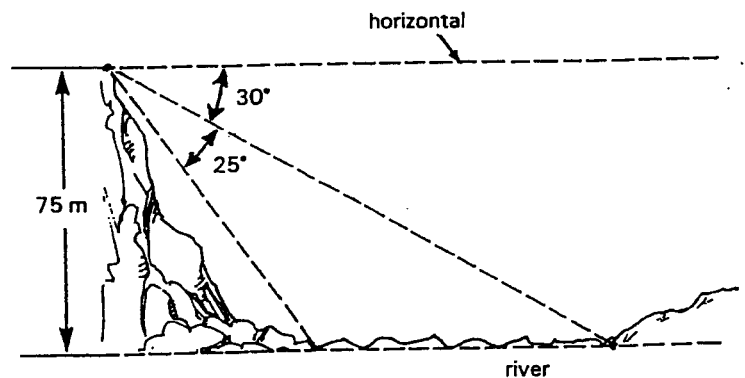


7. The angles of elevation to the top of a tree from points on either side of it are as shown.

If the tree is 11.8 m tall, what is the distance from A to B? Give your answer to one decimal place.



8. From the top of a cliff 75 m above a river, various angles are measured as shown in the diagram. Calculate the width of the river to the nearest metre.



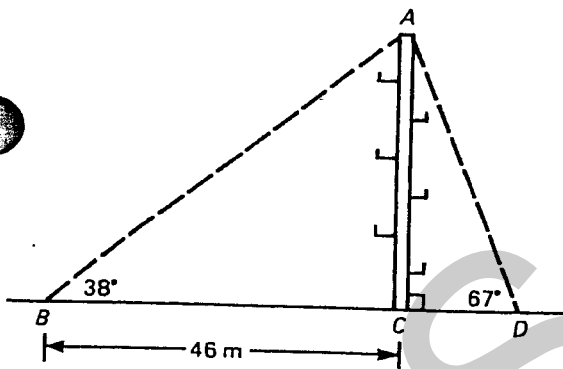
9. Evaluate without using a table or calculator.

- (a) $\sin 90^\circ$ (b) $\cos 30^\circ$ (c) $\tan 45^\circ$

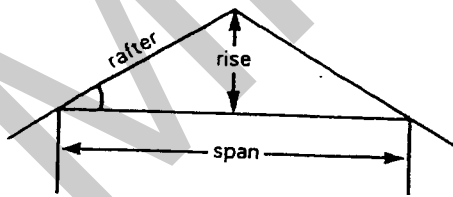
16. A line is drawn on the coordinate plane so that its y -intercept is twice its x -intercept.

- (a) Calculate the angle between the line and the x -axis.
- (b) Calculate the angle between the line and the y -axis.

17. Bernadette (B) and Dini (D) stand on opposite sides of a hydro pole at points B and D respectively. What is the distance between Bernadette and Dini to the nearest metre?

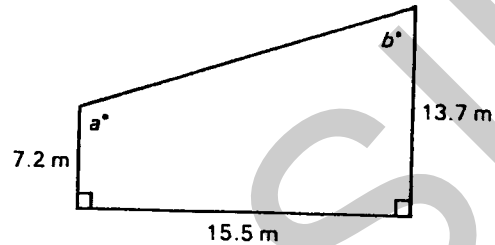


The *pitch* of a roof is determined by the ratio *rise* : *span*.



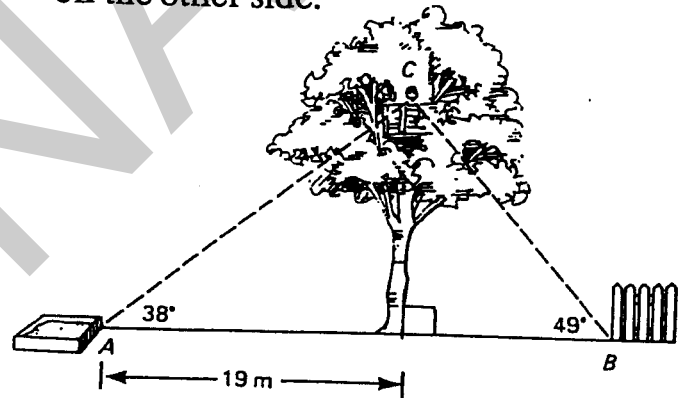
The pitch of a roof is 1 : 6 and the rise is 2.1 m, calculate the angle at the eaves to the nearest degree.

19. A driveway has the dimensions shown.



Determine the measures of the indicated angles correct to the nearest degree.

20. A child (C) in a tree house sees a sandbox on one side of the tree and a fence on the other side.



Use the given measurements to calculate each distance correct to one decimal place.

- (a) the height of the child above ground in metres
- (b) the distance between the sandbox at A and the fence post at B

21. To determine the approximate height of a building, Jason counts off 42 paces from its base. He then measures the angle of elevation of the top of the building to be 32° . If Jason's pace averages 0.8 m, and the horizontal from his eyes is 1.9 m above the ground, calculate the height of the building to the nearest metre.

Exercise

1. Solve the triangle $\triangle ABC$, given that $\angle C$ is a right angle, and:

(a) $a = 10$ and $b = 24$

(b) $\angle A = 48^\circ$ and $c = 12$

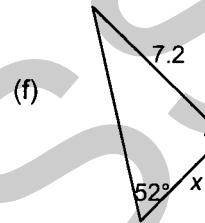
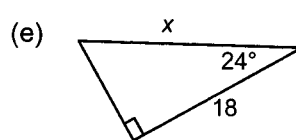
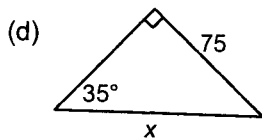
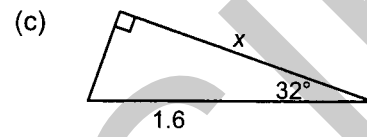
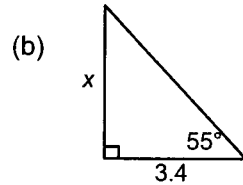
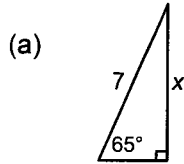
(c) $a = 1.6$ and $c = 2.4$

(d) $\angle B = 34^\circ$ and $b = 17$

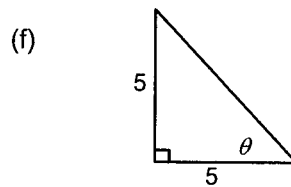
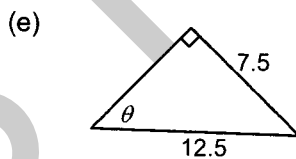
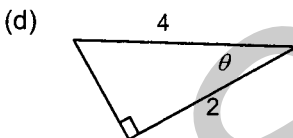
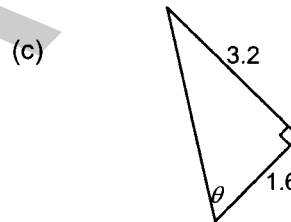
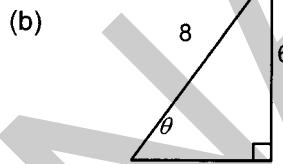
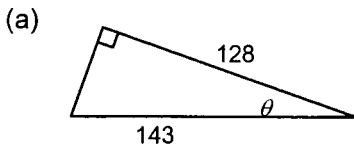
(e) $\angle A = 18.6^\circ$ and $b = 18.8$

(f) $b = 56$ and $c = 124$

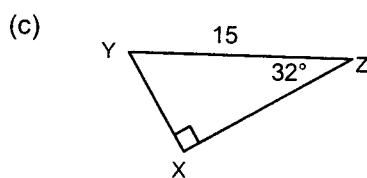
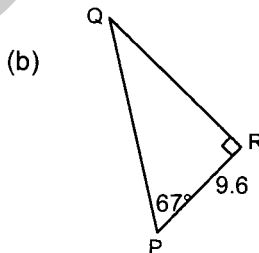
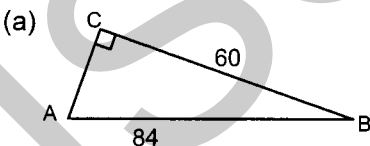
2. Find the value of the side labeled x correct to the nearest tenth.



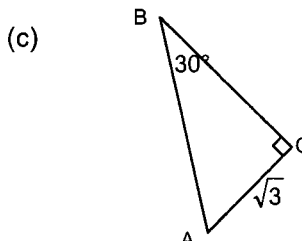
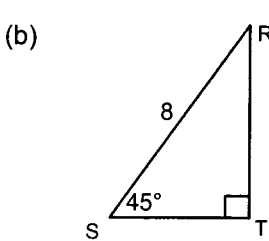
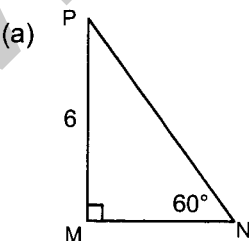
3. Find the angle θ correct to the nearest degree.



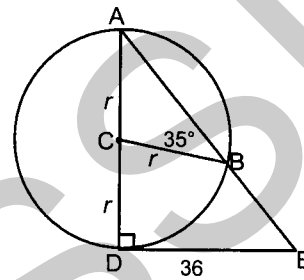
4. Solve the right triangle



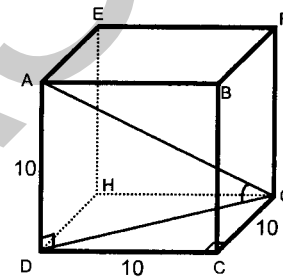
5. Solve for the exact values of the right triangle



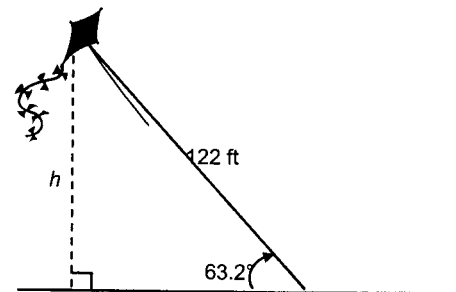
6. A ladder 10 ft in length reaches 9 ft up a wall against which it leans. Find the angle, to the nearest degree, that the ladder makes with the wall.
7. A road up a hill makes an angle of 4.5° with the horizontal. If this road is 5.2 miles long, how high is the hill, to the nearest hundred feet?
8. When the angle of elevation of the sun is 75° a building casts a shadow of 125 ft. How tall is the building the nearest foot?
9. A 6 ft man casts a shadow that is 14 ft long. What is the angle of elevation of the sun, to the nearest degree?
10. The circle shown has a radius of r , and a center at C . If the distance $DE = 36$ cm, find the radius of the circle to the nearest centimeter.



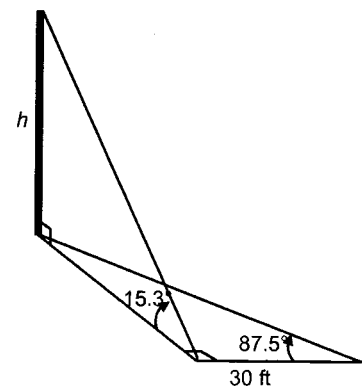
11. The cube shown has a side length of 10 cm. Find the angle formed by the diagonals AG and DG (correct to the nearest tenth of a degree.)



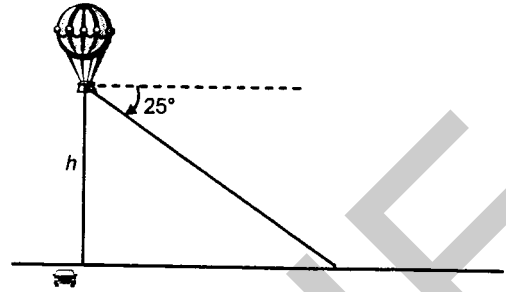
12. A kite string is extended 122 ft in length when the kite makes an angle of elevation of 63.2° with the ground. Find the altitude of the kite to the nearest foot.



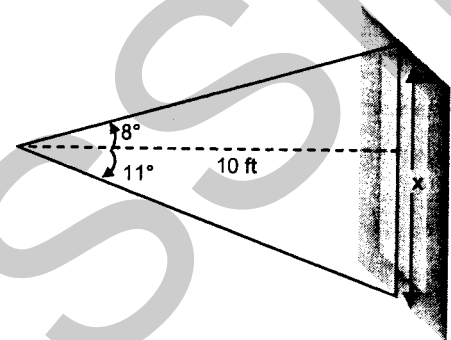
13. To measure the height of a tower across a freeway, a student takes two measurements. She stands directly across from the point at the foot of the tower, and finds that the angle of elevation to the top of the tower is 15.3° . She then walks 30 ft parallel to the freeway (at a right angle to the point at which she took the measure) and then finds that the angle from her new location to the base of the tower is 87.5° . Using this information, find the height of the tower correct to the nearest foot.



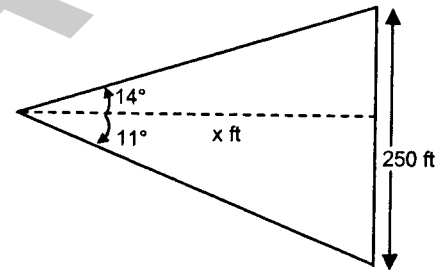
14. A hot air balloon is floating above a straight stretch of highway. To estimate how high above the ground the balloon is floating, the passengers of the balloon take measurements of a car below them. They assume that the car is traveling at 50 miles per hour. One minute after the car passes directly below the balloon they take a bearing on the car and find that the angle of depression to the car is 25° . Find the altitude of the balloon to the nearest 100 ft.



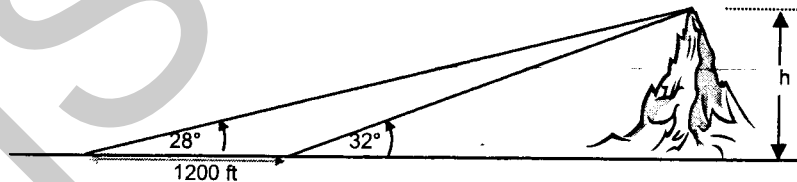
15. A man is standing 10 ft from a painting. He notices that the angle of elevation from his eyes to the top of the painting is 8° and the angle of depression to the bottom of the painting is 11° . Find the height of the painting to the nearest tenth of a foot.



16. A person standing on hill sees a tower that she knows to be 250 ft high. She observes that the angle of elevation to the top of the tower is 14° , while the angle of depression to the foot of the tower is 11° . How far is she from the tower, correct to the nearest foot?



17. To estimate the height of a particular mountain, the angle of elevation to the top of the mountain is measured to be 28° . 1200 ft closer to the mountain the angle of elevation is found to be 32° . What is the height of the mountain to the nearest hundred feet?



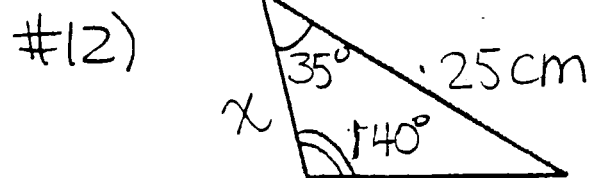
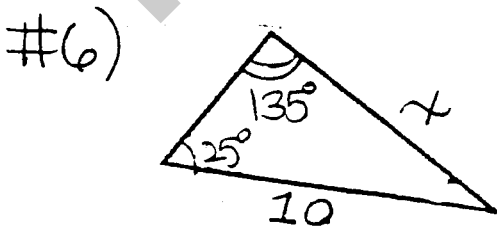
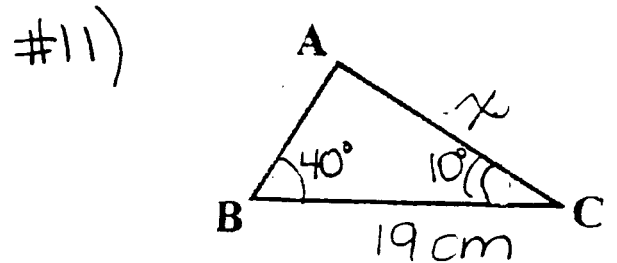
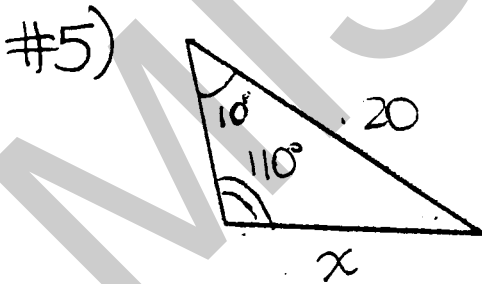
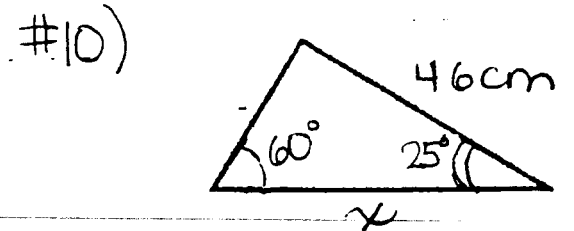
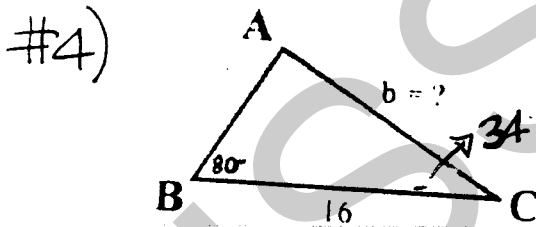
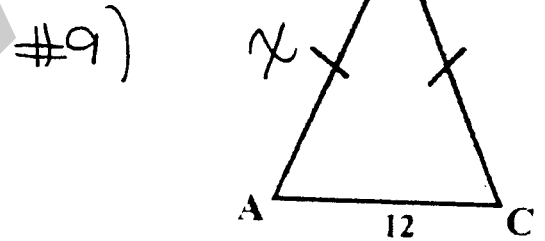
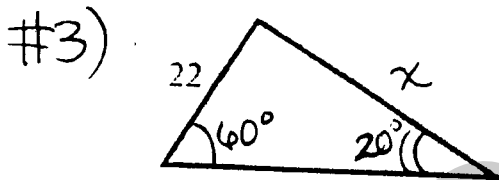
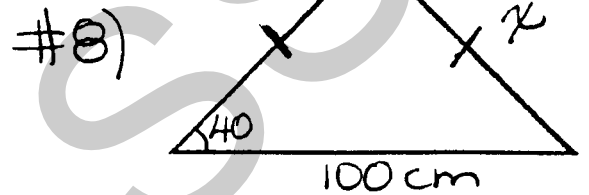
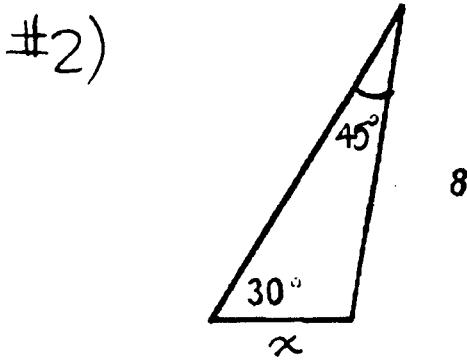
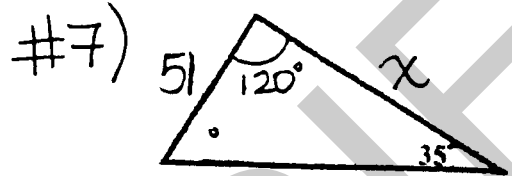
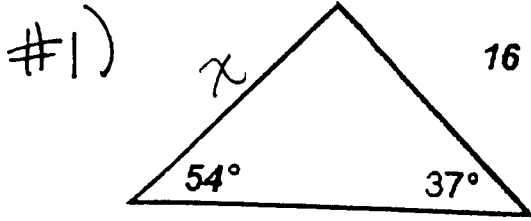
18. Find the dimensions of the sheet of paper needed to draw an octagon of side 12 cm, to the nearest centimeter.

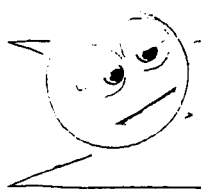
NAME OF STUDENT



**Sine Law
TERM 3**

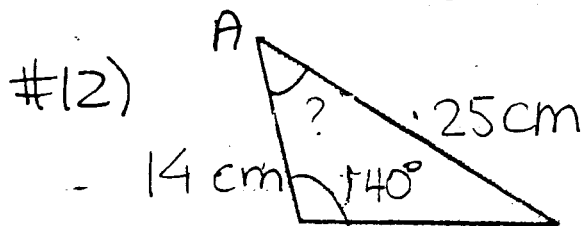
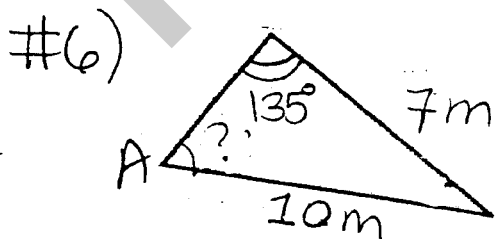
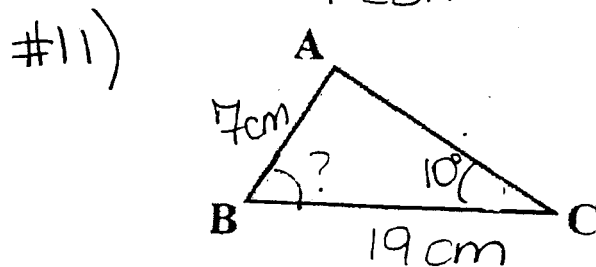
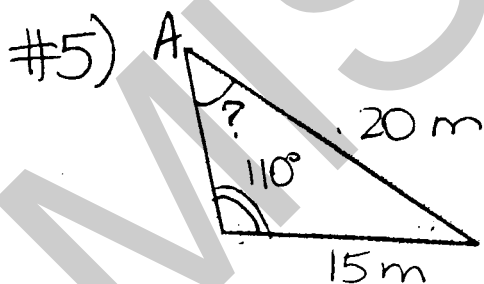
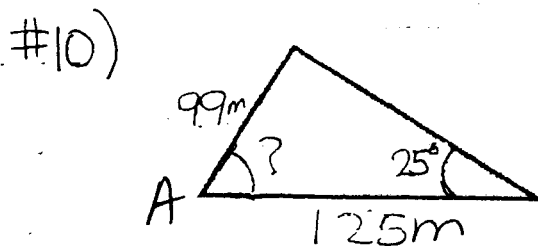
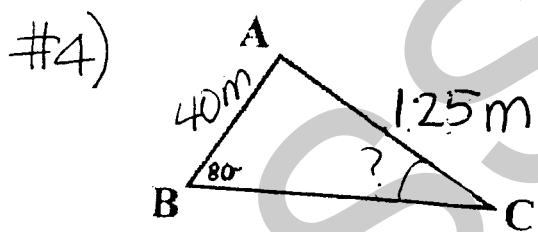
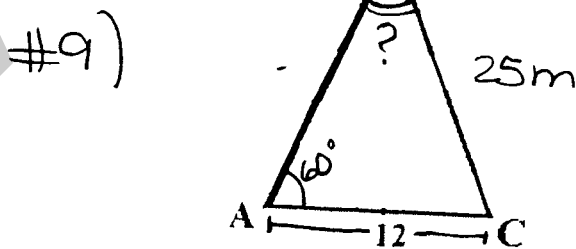
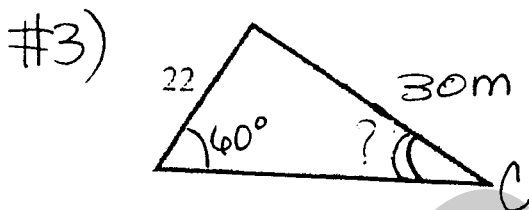
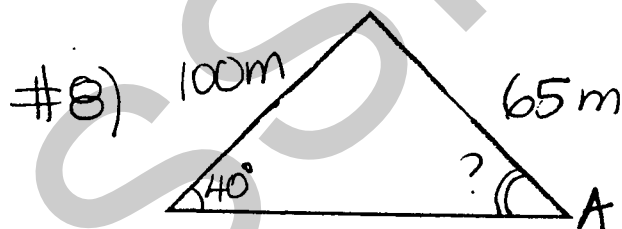
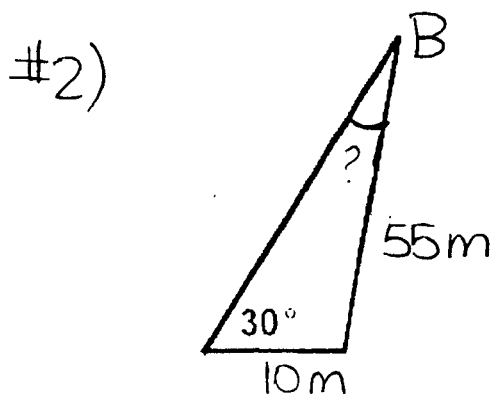
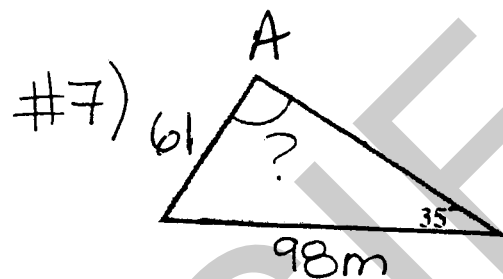
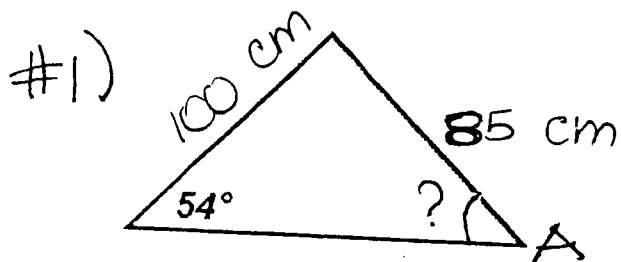
Find the value of side x .



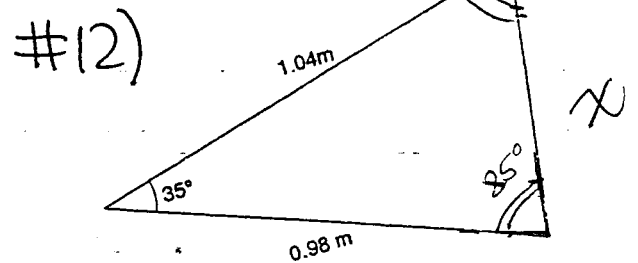
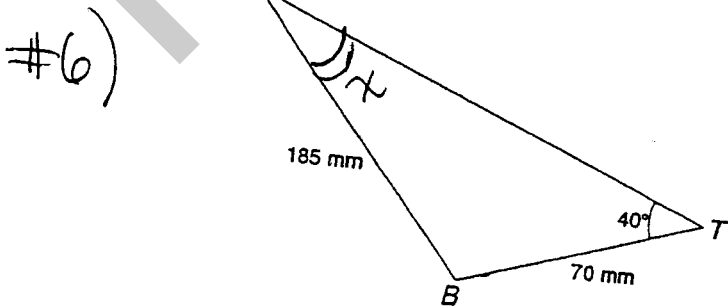
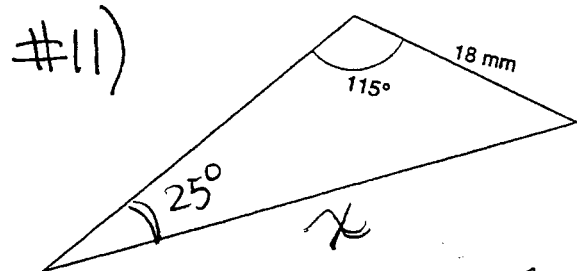
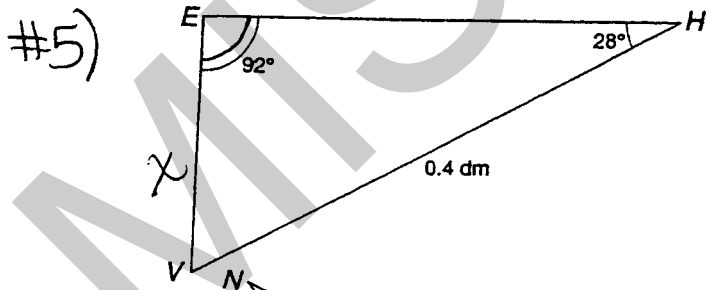
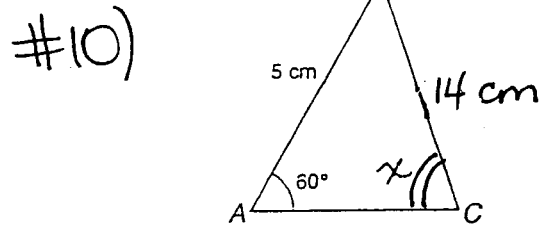
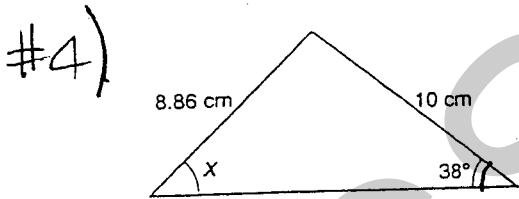
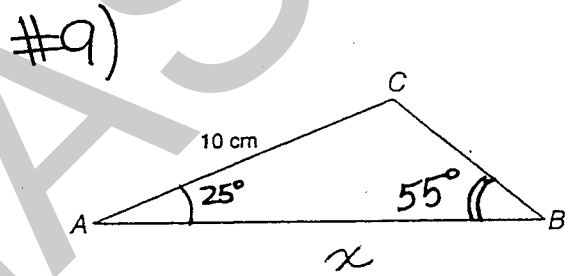
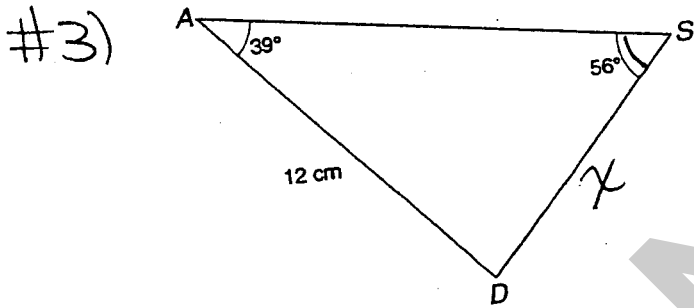
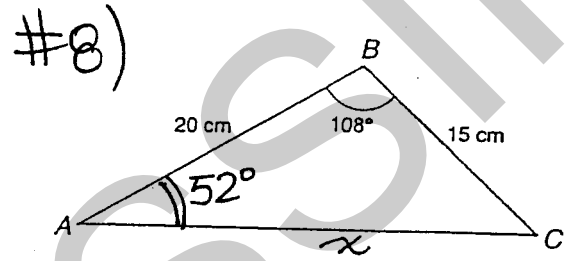
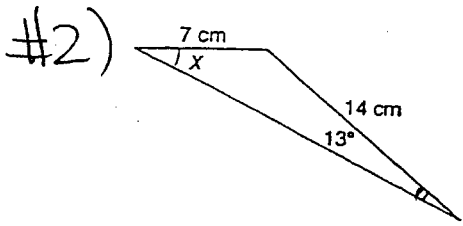
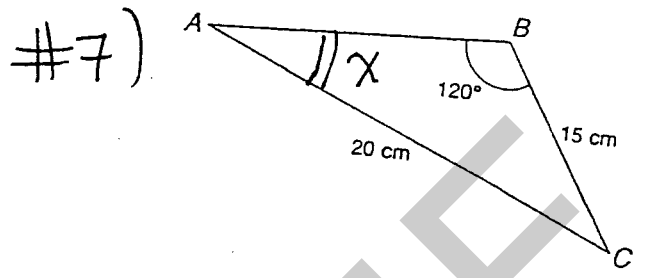
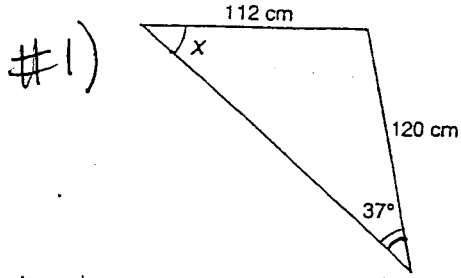


PRACTICE

Find the missing angle.



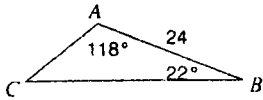
MIXED: Find the value of x in each case.



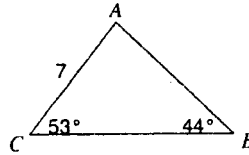
Sine Law

Find the measure indicated.

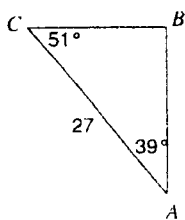
1) Find AC



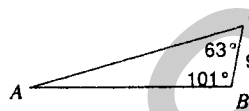
2) Find AB



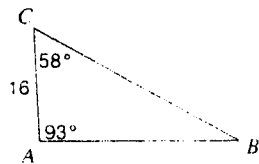
3) Find BC



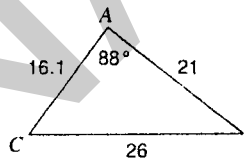
4) Find AB



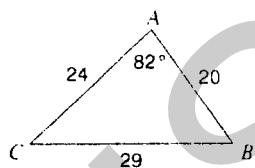
5) Find BC



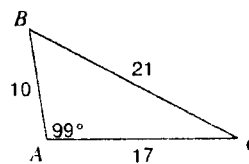
6) Find $m\angle C$



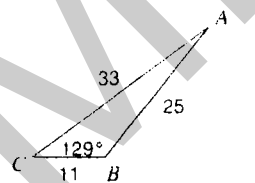
7) Find $m\angle C$



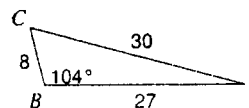
8) Find $m\angle C$



9) Find $m\angle A$

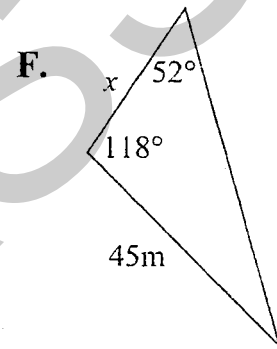
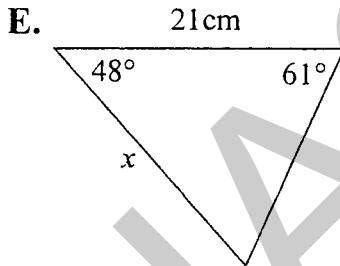
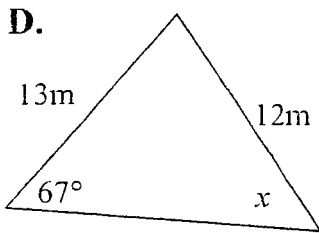
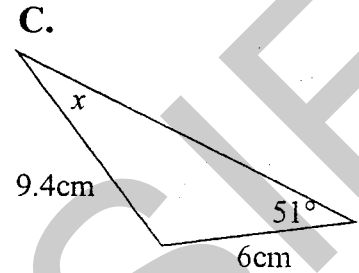
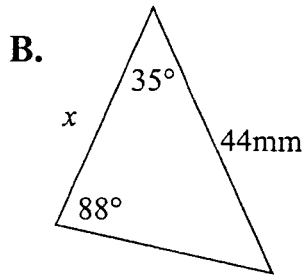
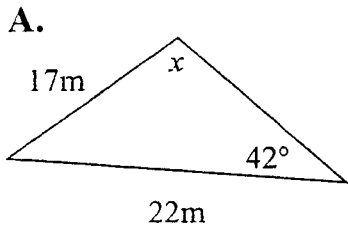


10) Find $m\angle A$

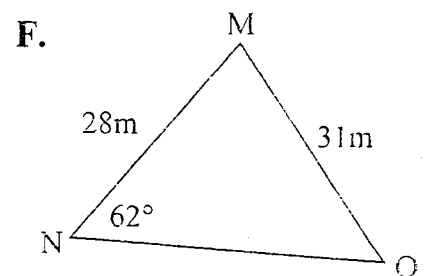
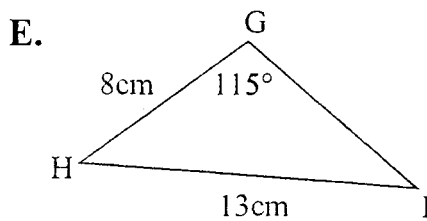
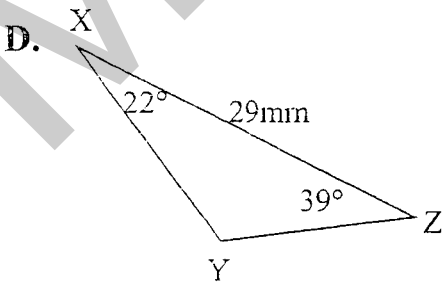
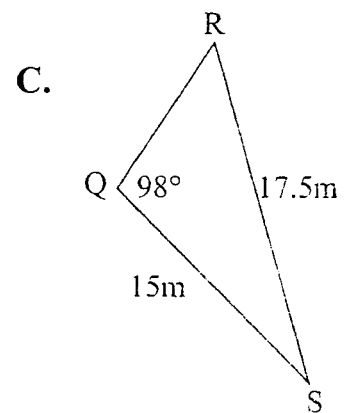
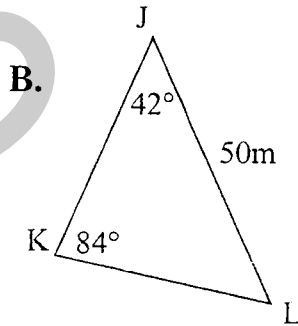
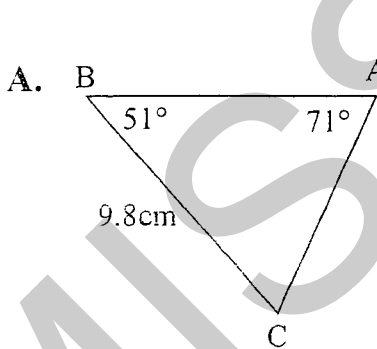


SINE LAW WORKSHEET

1. Solve for the unknown in each triangle.



2. Solve for all missing sides and angles in each triangle.

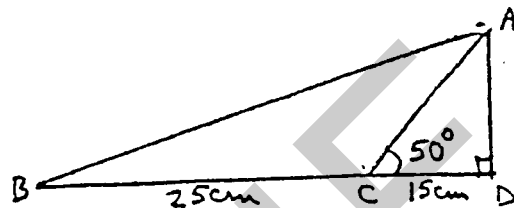


Trigonometry Word Problems

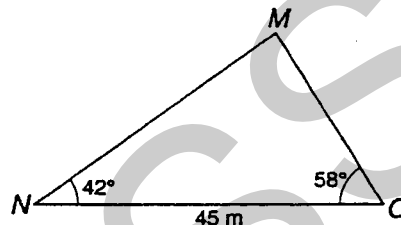
1. IN THE TRIANGLE BELOW, FIND:

a) $m \overline{AC}$

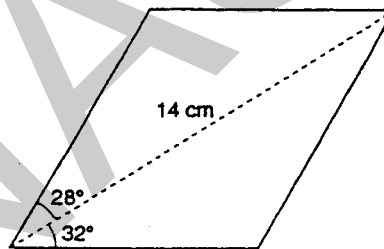
b) $m \overline{AB}$



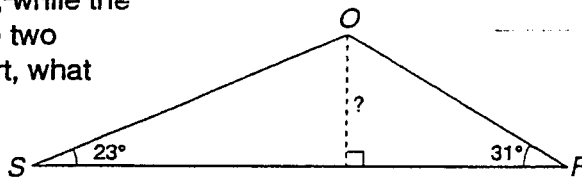
2. One side of a triangular field measures 45 m and forms angles of 42° and 58° with each of the other two sides. Find the perimeter of the field to the nearest metre.



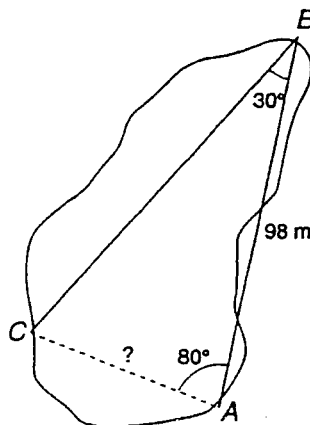
3. The longer diagonal of a parallelogram is 14 cm long, and forms angles of 32° and 28° with the parallelogram's two sides. Calculate the measures of these two sides to the nearest tenth of a centimetre.



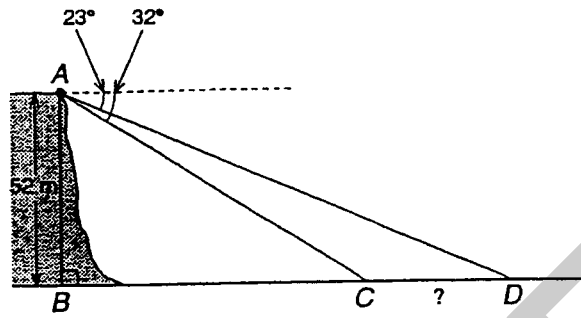
4. Two drivers stuck on a highway spot a UFO. The first driver sees the UFO at a 23° angle of elevation, while the second sees it at a 31° angle of elevation. If the two drivers are facing each other and are 8 km apart, what is the UFO's altitude, to the nearest metre?



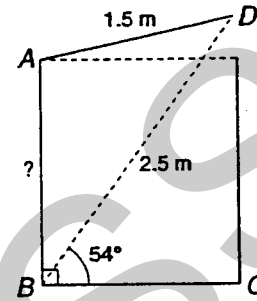
5. Lori uses the following method to find the width of a lake at a given point: she picks three points A, B and C, then measures segment AB and angles A and B. Given the measures (in metres) shown on the diagram, calculate the width of the lake to the nearest metre.



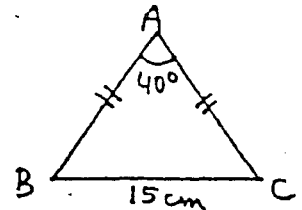
6. While standing at the top of a 52 m cliff, Jenny sees one boat at a 23° of depression, then another one at a 32° angle of depression. Find the distance between the two boats to the nearest metre.



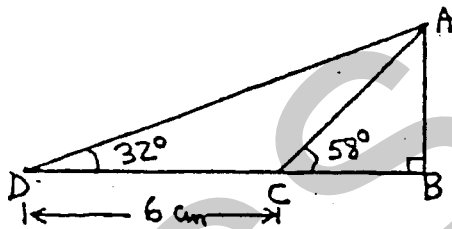
7. A box shaped like a rectangular prism has a 1.5 m lid. The lid is propped up by a 2.5 m long metal rod that forms a 45° angle with the bottom of the box. What is the height of the box to the nearest tenth of a metre?



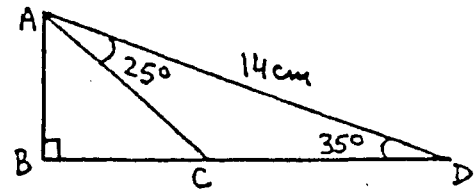
8. TRIANGLE ABC IS ISOSCELES.
FIND THE MEASURE OF THE EQUAL SIDES



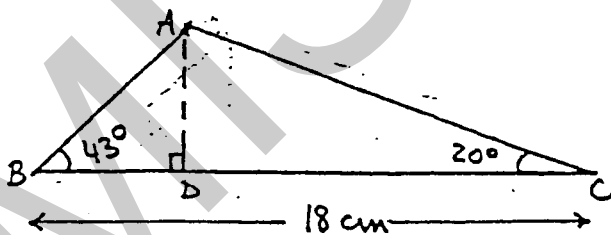
9. FIND THE MEASURE OF \overline{AB}



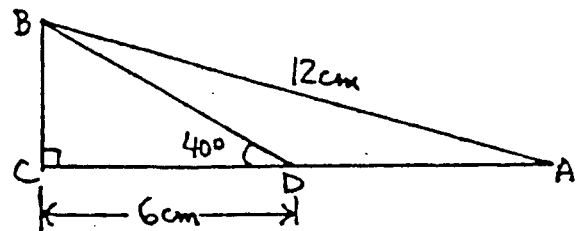
11. FIND THE MEASURE OF \overline{BC}



10. FIND THE MEASURE OF THE HEIGHT



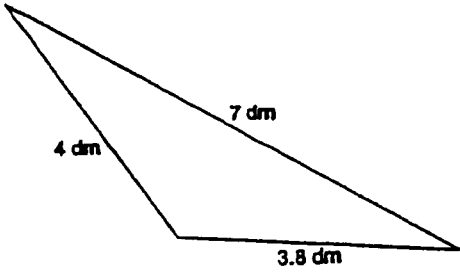
12. FIND THE MEASURE OF $\angle A$



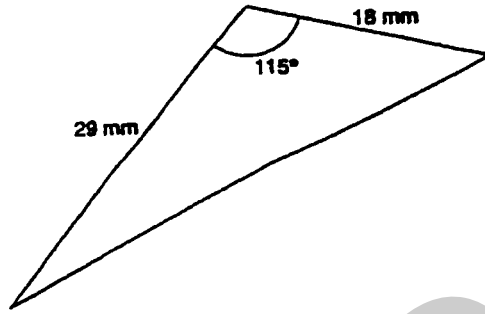
Area of Triangles

Find the area of each triangle.

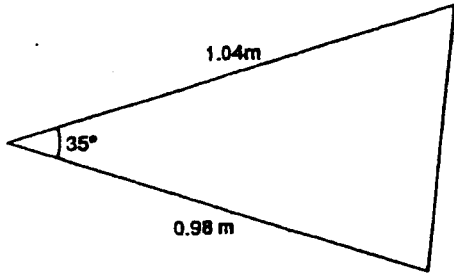
a)



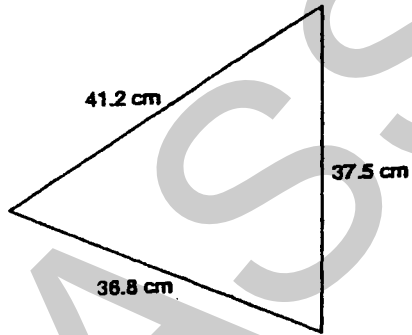
b)



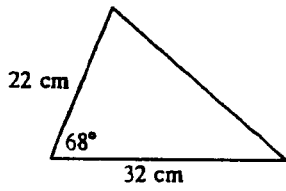
c)



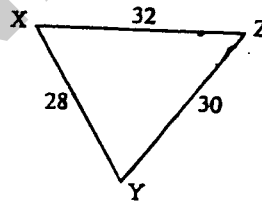
d)



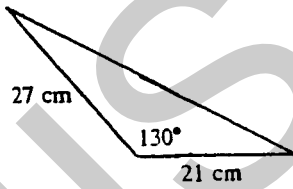
e)



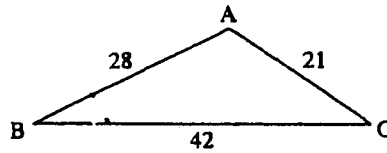
f)



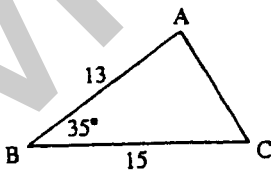
g)



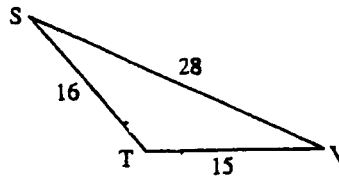
h)



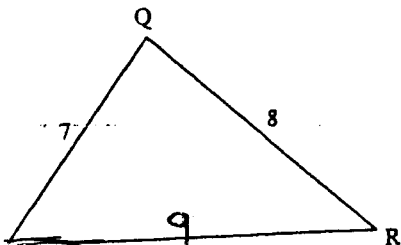
i)



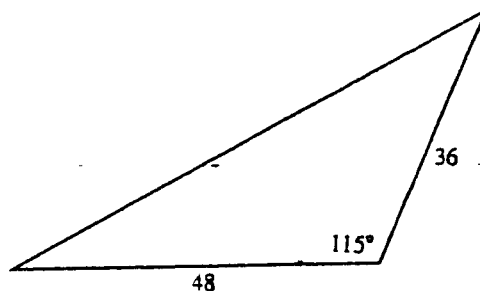
j)



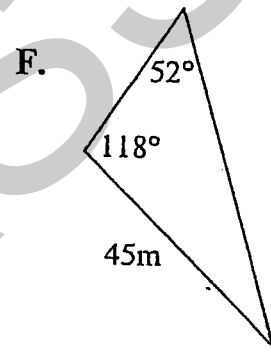
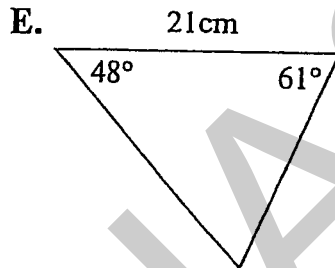
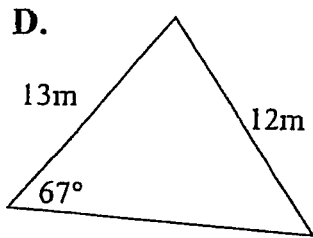
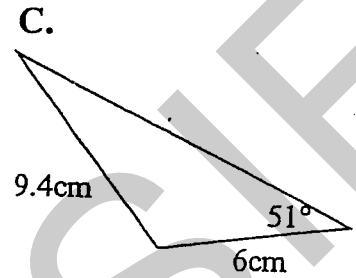
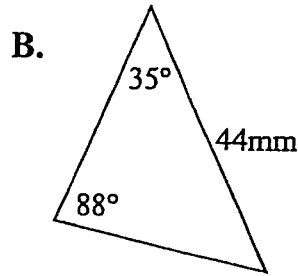
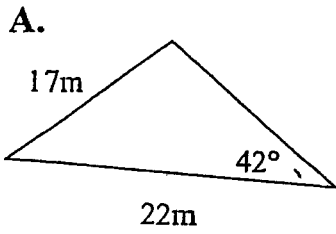
k)



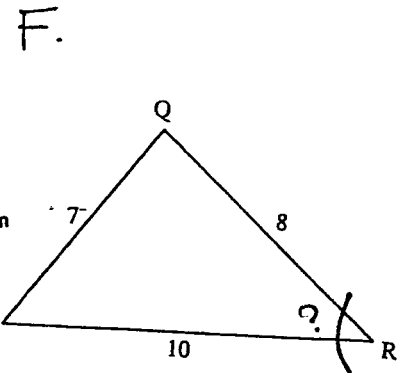
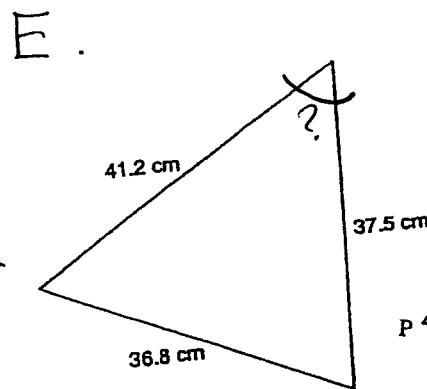
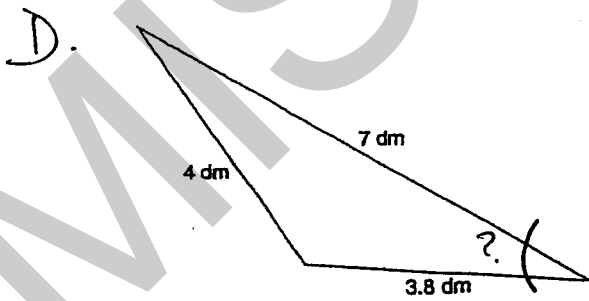
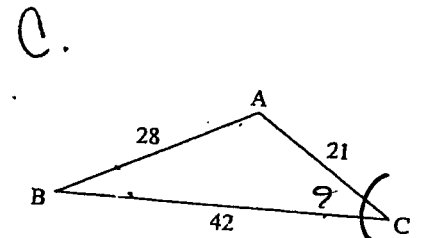
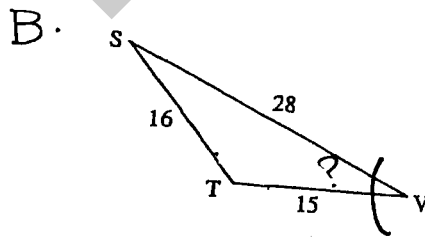
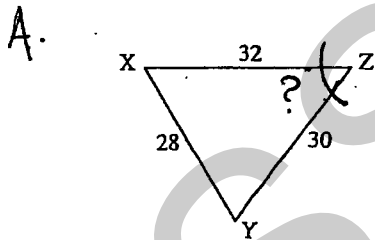
l)



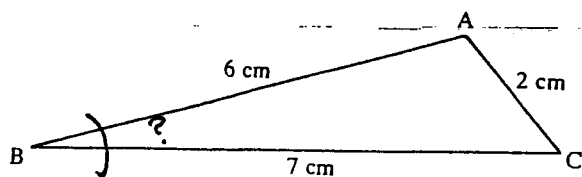
Find the area of each triangle



Find the indicated missing angle



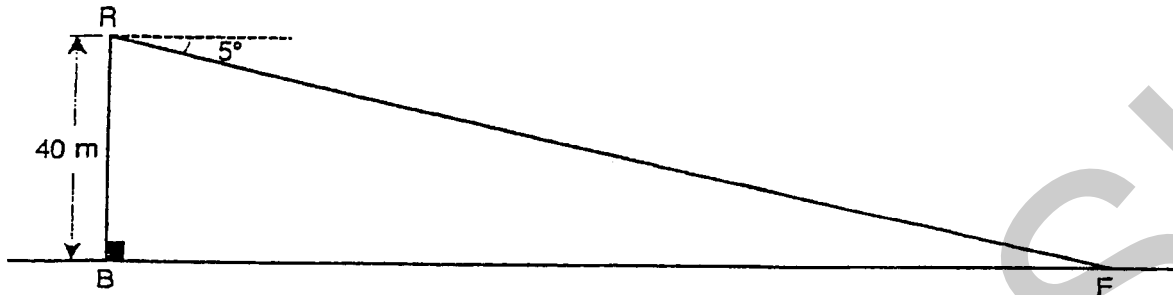
G.



Name: _____

Trigonometry Assignment

- ① From the top of an observation tower, which is 40 m high, a forest ranger sees a fire starting at an angle of depression of 5° .



How far is the fire from the base of the observation tower?

Round your answer to the nearest whole number.

ANS: _____

- ② Triangle ABC shown on the right represents a plot of land in which:

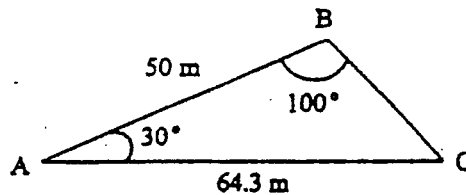
$$m \overline{AC} = 64.3 \text{ m}$$

$$m \overline{AB} = 50 \text{ m}$$

$$m \angle B = 100^\circ$$

$$m \angle BAC = 30^\circ$$

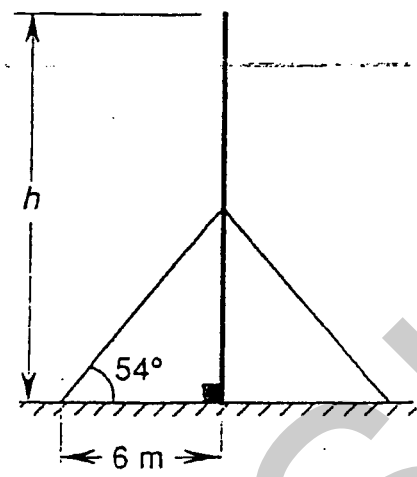
To the nearest m^2 , what is the area of the plot of land?



3

A mast is supported at the midpoint by two cables. The cables are anchored 6 m from the foot of the mast.

The angle of elevation from the ground to the points of attachment of these cables is 54° .



To the nearest tenth of a metre, what is height h of the mast?

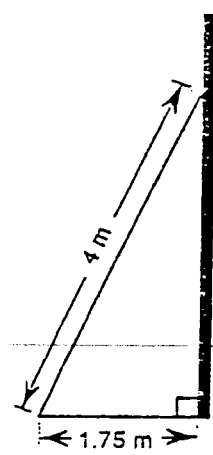
ANS: _____

Show your work.

4

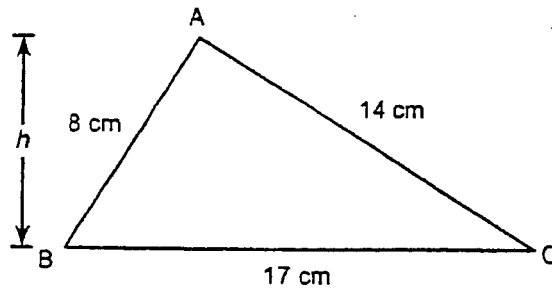
A flagpole is supported by a guy wire 4 m long. This guy wire is anchored to the ground 1.75 m from the foot of the flagpole.

What is the measure of the angle between the guy wire and the ground, to the nearest degree?



ANS: _____

- 5 Susan has drawn a sketch of a sculpture she plans to build. The dimensions are given below.

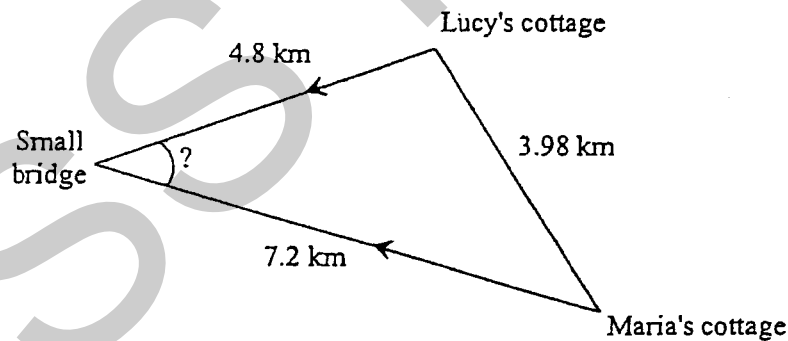


The sculpture must be packaged in a box.

Rounded to the nearest centimetre, what is the minimum height the box must have?

ANS: _____

- 6 Lucy's and Maria's cottages are 3.98 km apart. They decide to meet at the small bridge. Each girl skis on a cross-country trail toward the meeting point, as illustrated in the diagram. To reach the bridge, Lucy must ski 4.8 km and Maria must ski 7.2 km.



To the nearest degree, what is the measure of the angle formed by the two trails where they meet at the small bridge?

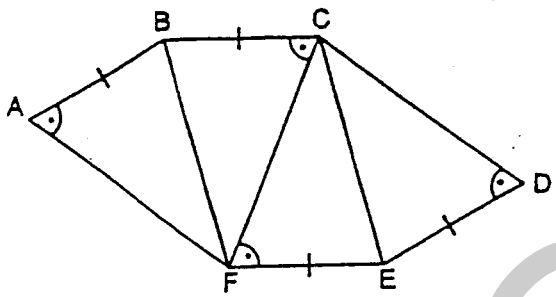
ANS: _____

7

In the figure below

$$\overline{AB} \cong \overline{BC} \cong \overline{FE} \cong \overline{ED}$$

$$\angle A \cong \angle BCF \cong \angle CFE \cong \angle D$$

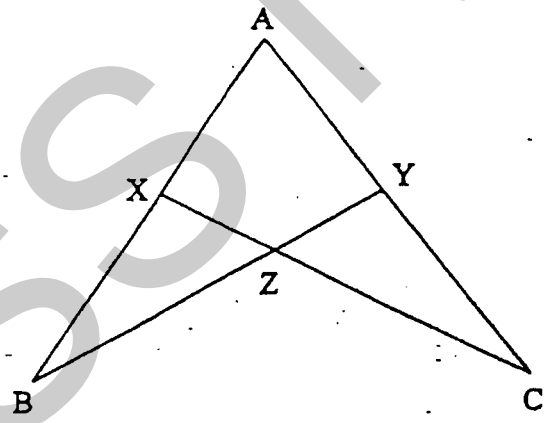


Using this information, which two triangles can be proven congruent?

- A) $\triangle BCF \cong \triangle CFE$
- B) $\triangle BCF \cong \triangle ABF$
- C) $\triangle CFE \cong \triangle CED$
- D) $\triangle ABF \cong \triangle CED$

8

In triangles $\triangle ABY$ and $\triangle ACX$ shown below, $\overline{AX} \cong \overline{AY}$ and $\overline{AB} \cong \overline{AC}$.

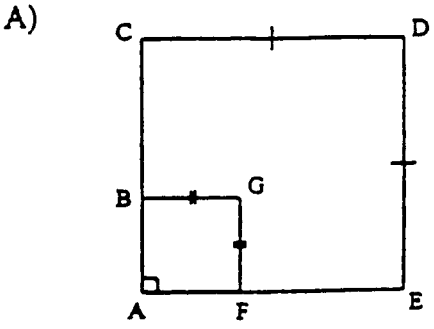


Which one of the following statements could be used to prove that triangle $\triangle ABY$ is congruent to triangle $\triangle ACX$?

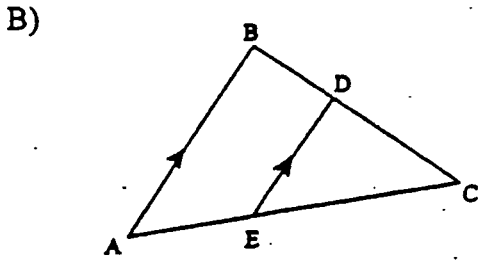
- A) If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent.(SSS)
- B) If two sides and a contained angle of one triangle are congruent to two sides and the contained angle of another triangle, then the triangles are congruent.(SAS)
- C) If two angles and a contained side of one triangle are congruent to two angles and the contained side of another triangle, then the triangles are congruent.(ASA)
- D) If two angles of one triangle are congruent to two angles of another triangle, then the triangles are congruent.(AA)

9

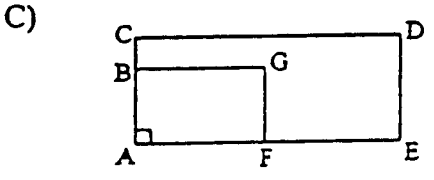
Each diagram compares two figures. Which statement is NOT necessarily true?



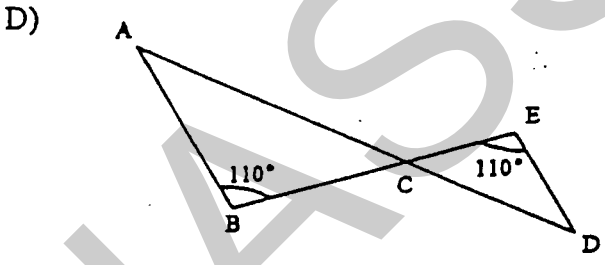
Square ACDE is similar to square ABGF.



Triangle ABC is similar to triangle EDC.



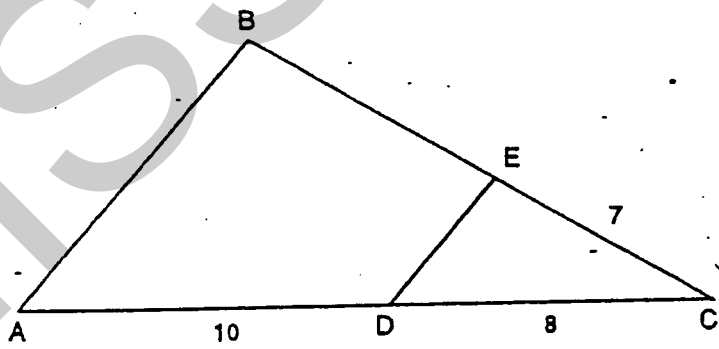
Rectangle ACDE is similar to rectangle ABGF.



Triangle ABC is similar to triangle DEC.

10

In triangle ABC below, segment DE is parallel to segment AB. The measurements are given in metres.

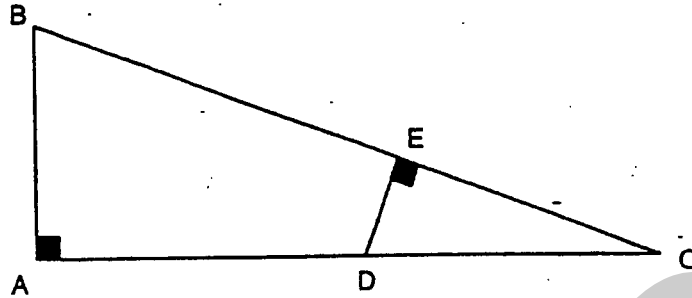


Rounded to the nearest hundredth of a metre, what is the length of segment BC?

- A) 8.75 m
- B) 11.43 m
- C) 15.75 m
- D) 16.00 m

11

Triangles ABC and DEC are similar.



Which of the following statements is true?

A) $\frac{m \overline{ED}}{m \overline{AB}} = \frac{m \overline{EC}}{m \overline{AC}}$

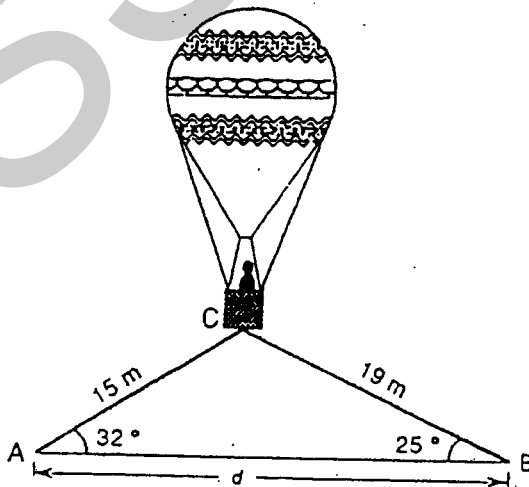
B) $\frac{m \overline{EC}}{m \overline{BC}} = \frac{m \overline{DC}}{m \overline{AC}}$

C) $\frac{m \overline{DC}}{m \overline{BC}} = \frac{m \overline{AB}}{m \overline{ED}}$

D) $\frac{m \overline{BC}}{m \overline{DC}} = \frac{m \overline{ED}}{m \overline{AB}}$

12

A hot-air balloon is anchored by two cables, one 15 m long and the other 19 m long. The angle of elevation of the shorter cable is 32° while that of the longer cable is 25° .

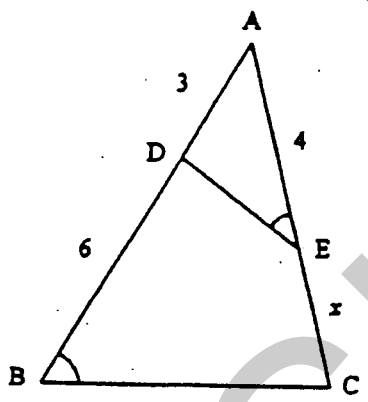


To the nearest metre, what distance d separates the points where the two cables are anchored?

13

In triangles ABC and AED shown on the right,
 $\angle AED = \angle ABC$.

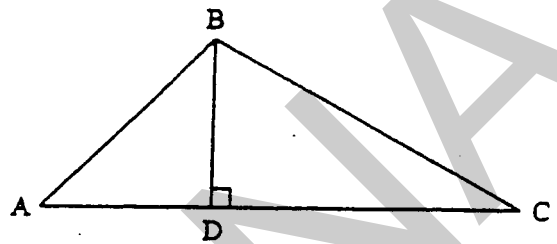
- $m \overline{AD} = 3 \text{ cm,}$
- $m \overline{DB} = 6 \text{ cm,}$
- $m \overline{AE} = 4 \text{ cm.}$



Which of the following is the measure of \overline{EC} ?

- A) 2.75 cm
- B) 4.5 cm
- C) 8 cm
- D) 12 cm

14

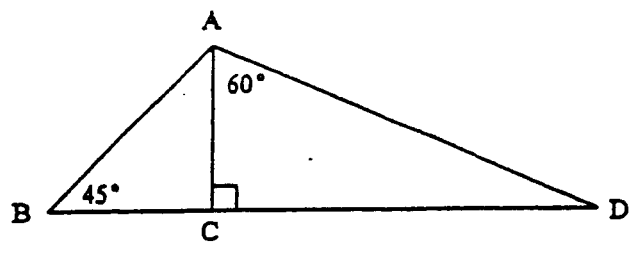


Which of the following trigonometric ratios can be used to determine the measure of angle C?

- A) $\cos C = \frac{m \overline{AB}}{m \overline{AC}}$
- B) $\cos C = \frac{m \overline{CD}}{m \overline{BC}}$
- C) $\cos C = \frac{m \overline{BD}}{m \overline{BC}}$
- D) $\cos C = \frac{m \overline{AC}}{m \overline{BC}}$

15

In the diagram below, segment AC is an altitude. The measures of angles DAC and ABC are 60° and 45° respectively.

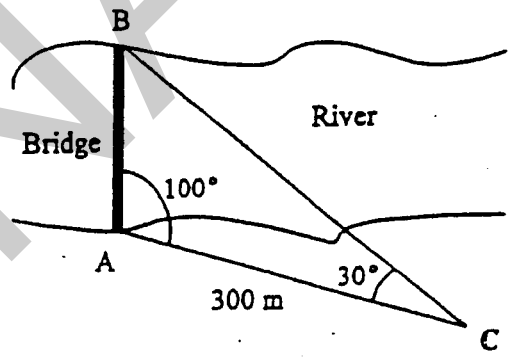


Which of the following statements is true?

- A) $m \overline{AC} = \frac{m \overline{AD}}{2}$
- B) $m \overline{AC} = \frac{m \overline{CD}}{2}$
- C) $m \overline{AB} = \frac{m \overline{AD}}{2}$
- D) $m \overline{AB} = m \overline{AC}$

A bridge is to be constructed across a river between points A and B as shown.

A surveyor stood at point C which was 300 metres from point A. The sightings taken indicated that $m \angle A = 100^\circ$ and $m \angle C = 30^\circ$.

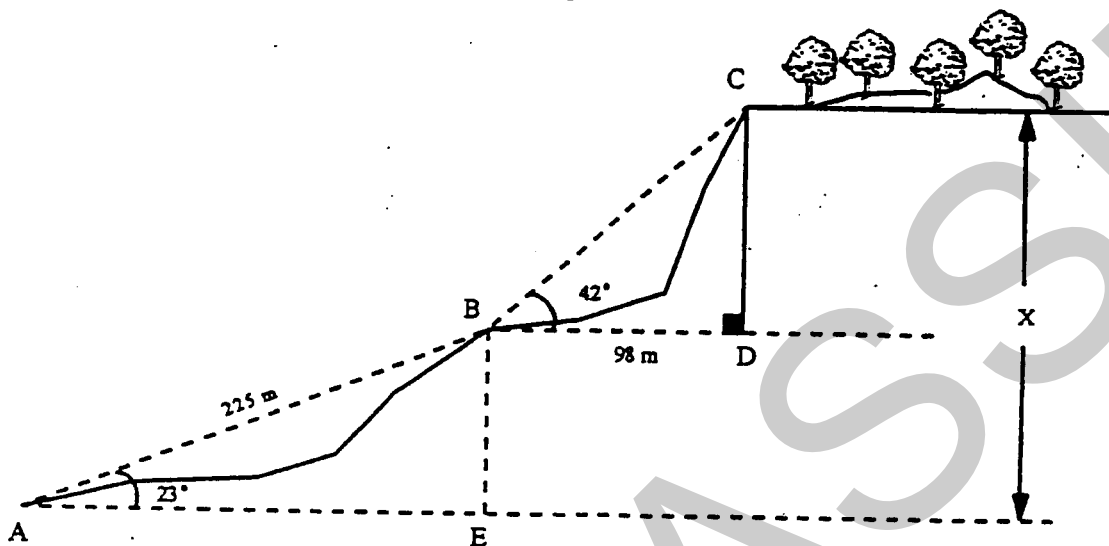


To the nearest metre, what is the length of the bridge?

- A) 152 m
- B) 196 m
- C) 386 m
- D) 460 m

17) A land surveyor takes several measurements to determine the change in elevation on a certain piece of land. He notes that $\angle A = 23^\circ$; $m\angle B = 42^\circ$ and $m \overline{AB} = 225$ m.

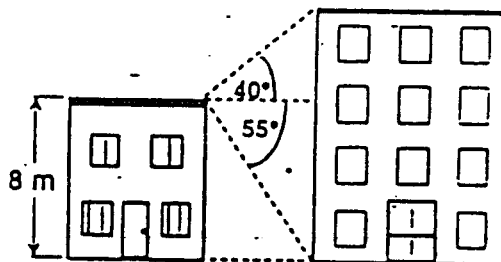
He also determines that the length of segment \overline{BD} is 98 m.



To the nearest metre, what is the total change, x , in elevation?

- A) 153 m
- B) 176 m
- C) 197 m
- D) 295 m

18) From the roof of a house 8 m high, the angle of elevation of the top of a building is 40° , and the angle of depression of the base of the building is 55° .



What is the height of the building to the nearest tenth?

- A) 11.6 m
- B) 12.7 m
- C) 13.6 m
- D) 15.3 m

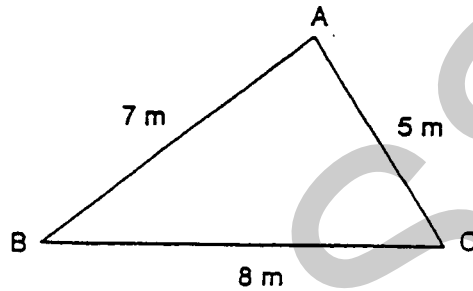
SECTION B This section of the exam comprises questions 16 to 25.

Show your work and your result.

Both your work and your result are taken into account when marks are allotted.

19

What is the area of this triangle to the nearest tenth of a square metre?

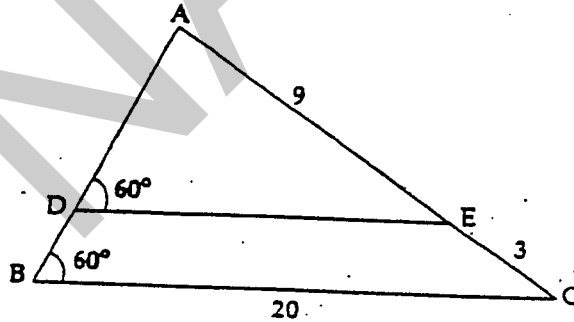


20

In the following diagram, triangles ABC and ADE are similar.

The measurements are given in metres:

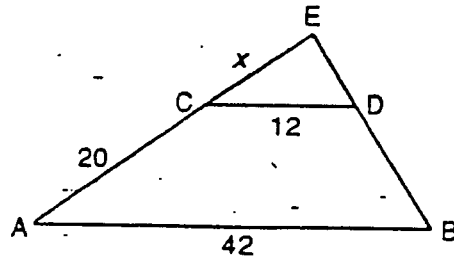
What is the measure of segment \overline{DE} ?



21

In the figure to the right, $\overline{AB} \parallel \overline{CD}$.

The measurements are given in metres.



What is the length of segment CE to the nearest metre?

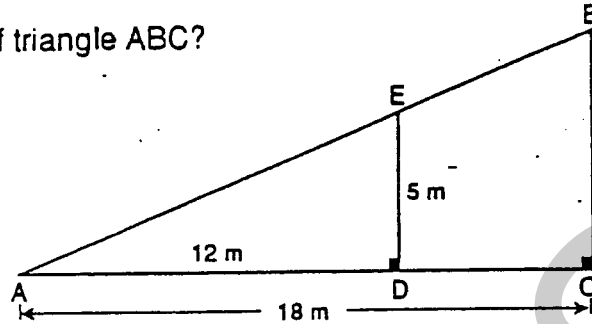
22

in triangle ABC illustrated below, angle C = 90°.

In this triangle, segment AC measures 18 m; segment ED is perpendicular to segment AC and measures 5 m; segment AD measures 12 m.

Triangles AED and ABC are similar.

What is the area of triangle ABC?

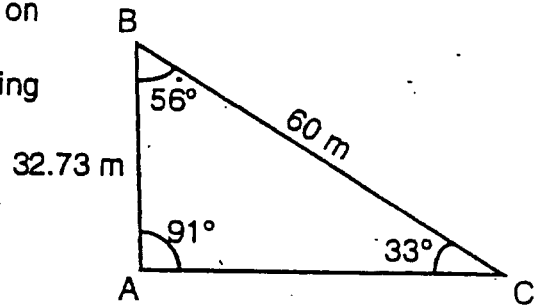


23

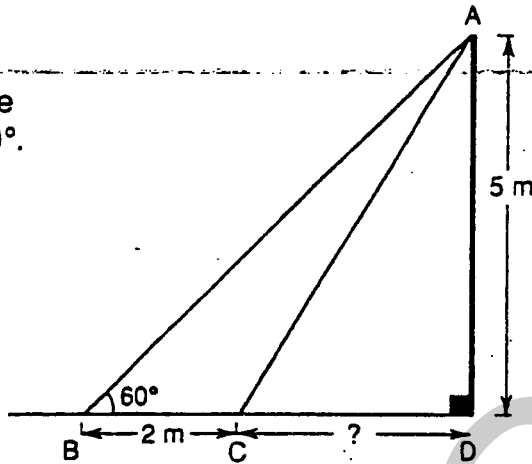
A triangular lot whose dimensions are shown on the diagram must be fenced.

The cost of fencing is \$7.95 per metre, including taxes.

How much will it cost to fence the lot?



- 24 A 5 m antenna is supported by two cables that are 2 m apart. The angle of elevation of the longer cable is 60° .



To the nearest tenth of a metre, what is the distance CD between the shorter cable and the base of the antenna?

25

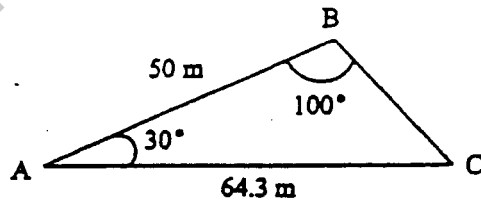
Triangle ABC shown on the right represents a plot of land in which:

$$m \overline{AC} = 64.3 \text{ m}$$

$$m \overline{AB} = 50 \text{ m}$$

$$m \angle B = 100^\circ$$

$$m \angle BAC = 30^\circ$$



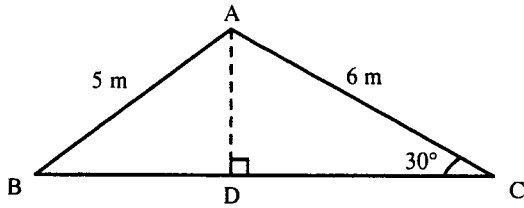
To the nearest m^2 , what is the area of the plot of land?

Name : _____

TRIGONOMETRY ASSIGNMENT SEC 4

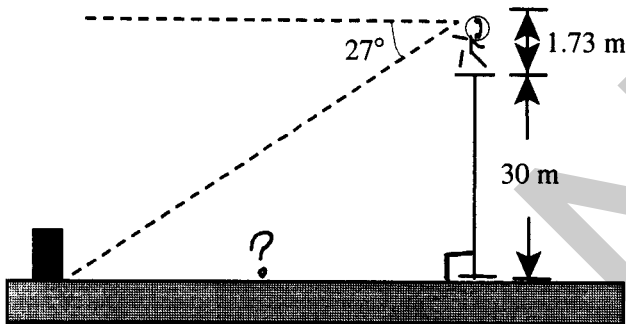
DUE: TODAY

- 1 Given triangle ABC and its height AD shown below:



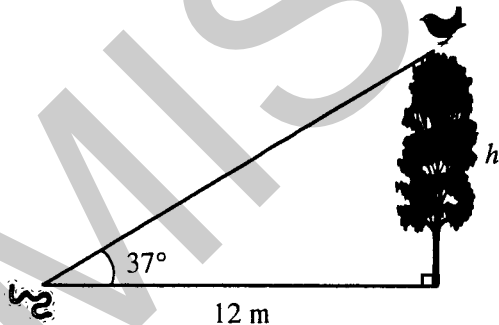
What is the measure of angle ABC ?

- 2 An individual who is 1.73 metres tall is standing on a tower that is 30 metres high. Using a clinometer, he is able to determine that the angle of depression between him and the base of the monument is 27° .



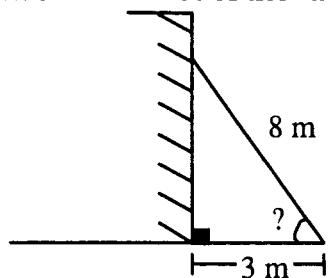
What is the approximate distance from the base of the tower to the base of the monument?

- 3 The diagram below shows a bird looking down at a worm.



What is the height of the tree to the nearest tenth of a metre?

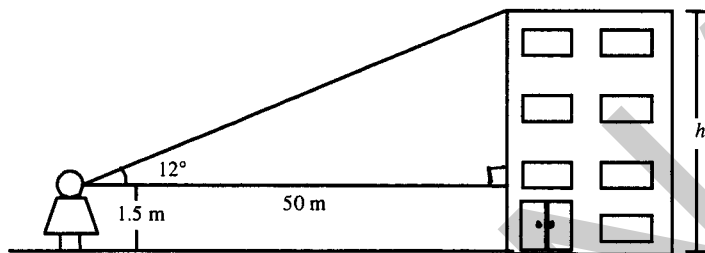
- 4 An 8-m ladder is leaning against a wall. The distance between the foot of the ladder and the



wall is 3 m.

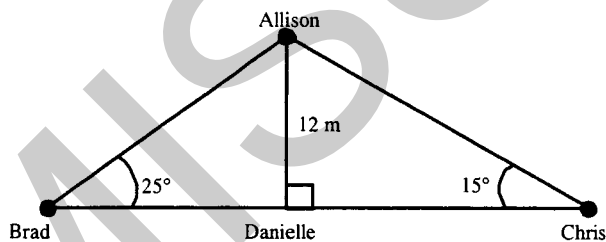
To the nearest tenth, what is the measure of the angle between the ladder and the ground?

- 5 Karine is on her way to school. As shown in the diagram below, at a distance of 50 metres, she observes the top of the school at an angle of elevation of 12° .



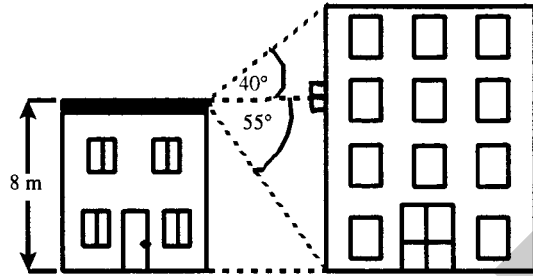
What is the height, h of the school?

- 6 Allison, Brad, Chris and Danielle are picking strawberries in a large field. Their positions are shown in the diagram below.



How far apart, to the nearest metre, are Brad and Chris?

- 7 From the roof of a house 8 m high, the angle of elevation of the top of a building is 40° , and the angle of depression of the base of the building is 55° .

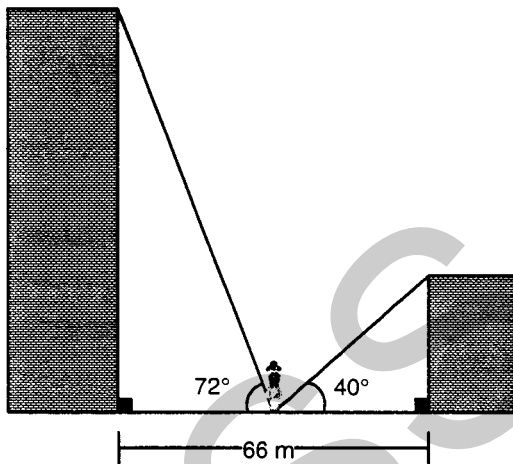


What is the height of the building to the nearest tenth?

- 8 Marie-Pierre is standing exactly half way between two office-building towers. These towers are on opposite sides of the street. Using a clinometer (a device used to measure angles) she calculates the angle formed by the top of each building. The two readings are 72° and 40° .

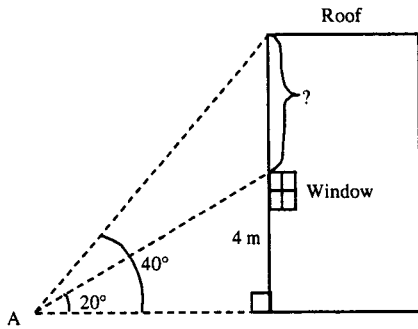
The distance between the two buildings is 66 metres.

What is the difference between the heights of the two buildings?
Round your answer to the nearest tenth of a metre.

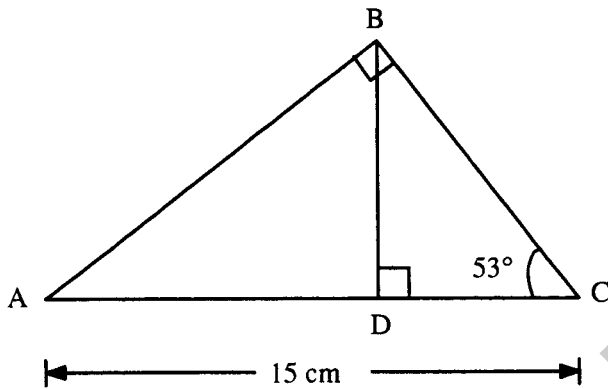


- 9 Krystal, standing at point A, uses a clinometer to determine the angles of elevation of her window and the roof of her house. These are 20° and 40° respectively. She knows that the top of her window is 4 m above the ground. This situation is represented in the diagram below.

To the nearest tenth of a metre, how far is it from the top of her window to the roof of her house?



- 10 Given triangle ABC with right angle B .

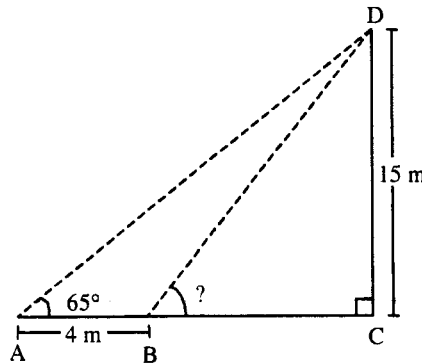


What is the measure of segment BD ?

- 11 Two bird watchers, 4 metres apart, are located at positions A and B as shown on the figure.

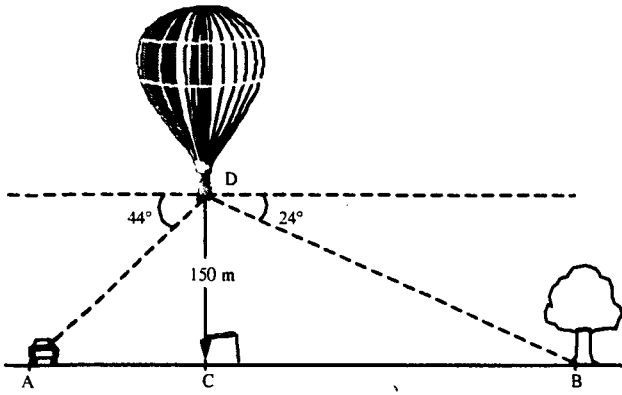
Both are looking at the top of a 15-metre tree.

From point A , the angle of elevation is 65° .



What is the angle of elevation of the bird watcher at position B ?

- 12 The pilot of a hot air balloon, looking to the east, sees a tree at an angle of depression of 24° . Looking to the west, he sees a car at an angle of depression of 44° .

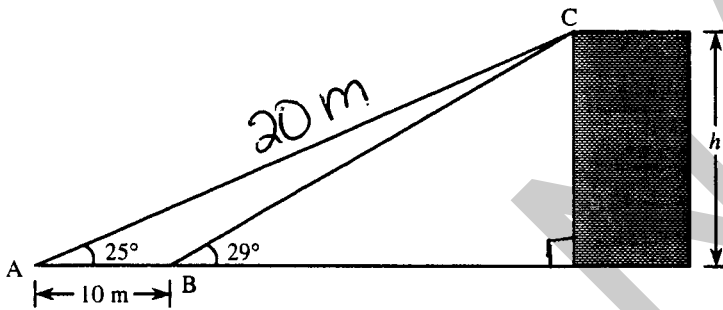


What is the distance from the car to the tree?

- 13 John wants to find the height of a building.

From point A, the angle of elevation to the top of the building is 25° . If he walks 10 m towards the building to point B, the angle of elevation is 29° .

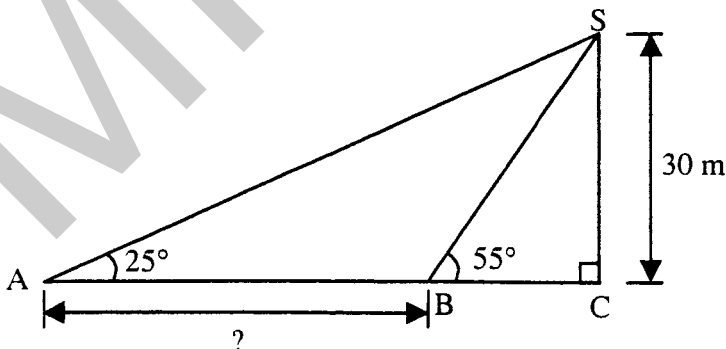
The situation is represented in the diagram below.



What is the height h of the building?

- 14 Allan, standing at point A, looks at the top of a building 30 m high. The angle of elevation is 25° .

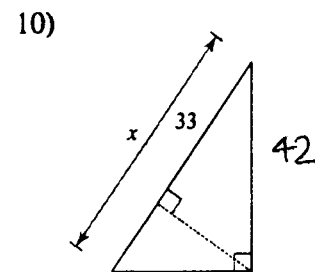
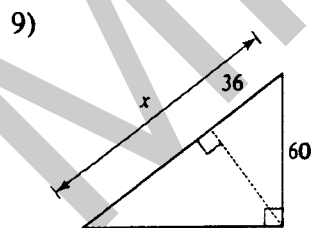
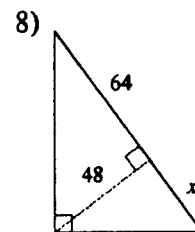
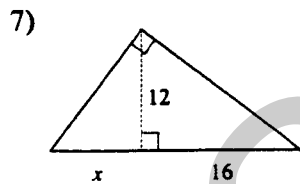
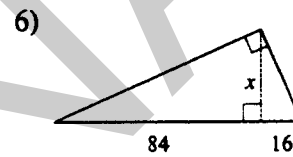
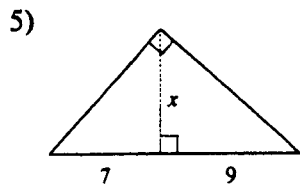
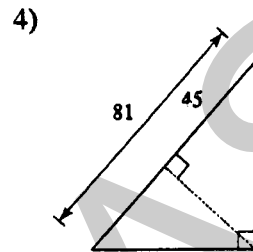
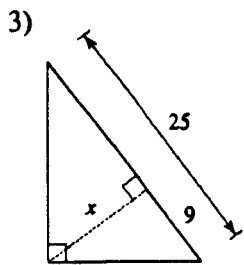
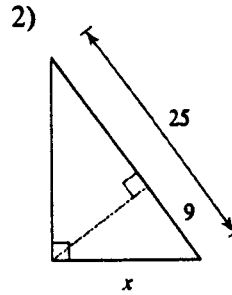
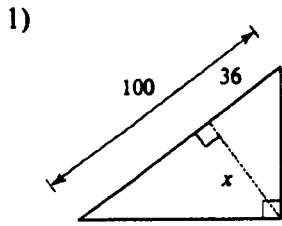
Bernard, standing at point B, looks at the top of the same building. The angle of elevation is 55° .



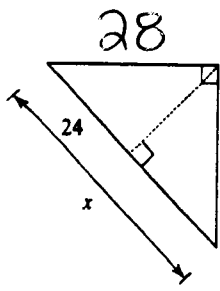
What is the distance between Allan and Bernard?

Metric Relations in a triangle

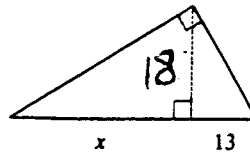
Find the missing length indicated.



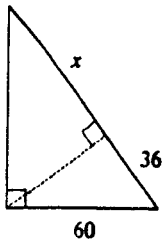
11)



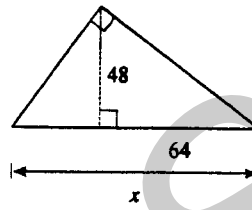
12)



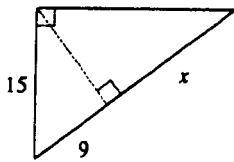
13)



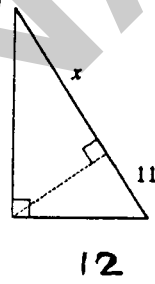
14)



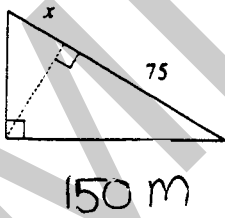
15)



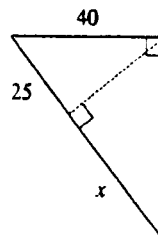
16)



17)



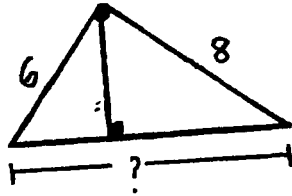
18)



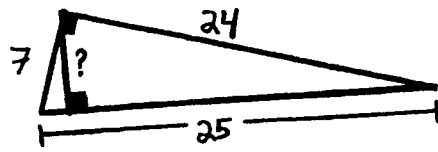
METRIC RELATIONS

Find the MISSING MEASURE.

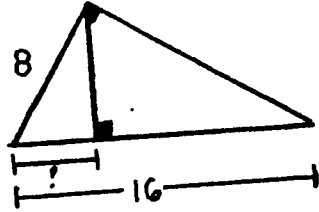
a)



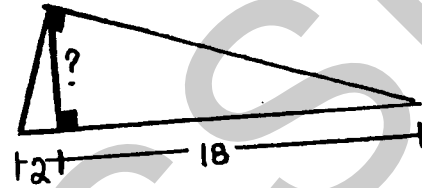
b)



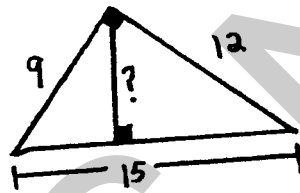
c)



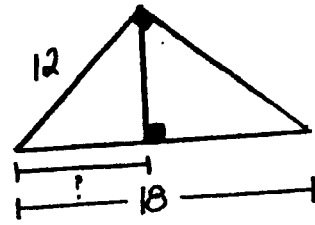
d)



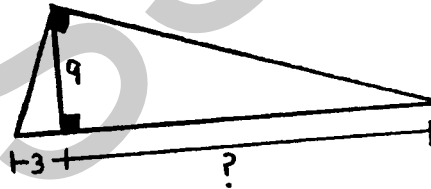
e)



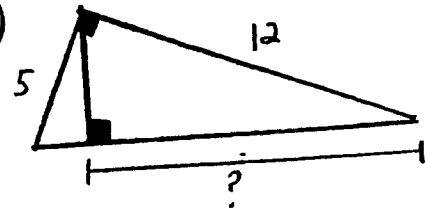
f)



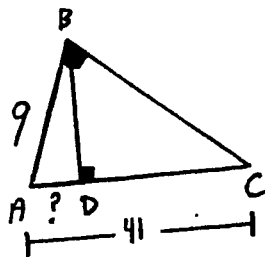
g)



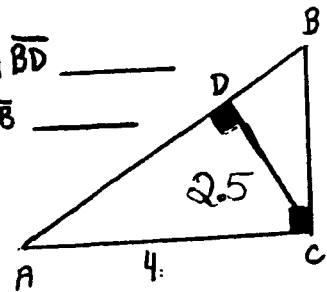
h)



i)



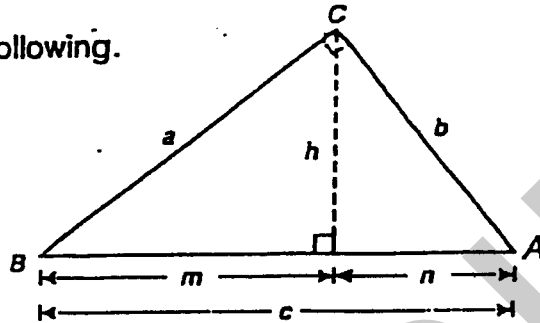
j) 1) $m \overline{BD}$ _____
2) $m \overline{CB}$ _____



PROBLEMS:

1. Use the diagram on the right to solve the following.

- If $m = 3$ and $c = 12$, find a .
- If $m = 6$ and $n = 2$, find b .
- If $m = 5$ and $n = 4$, find h .
- If $a = 3$ and $b = 8$, find h .



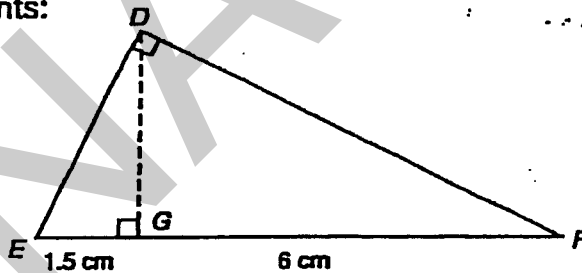
2. From the given triangle, calculate the following:

- $m\overline{AH}$
- $m\overline{BH}$
- $m\overline{BC}$
- $m\overline{AB}$



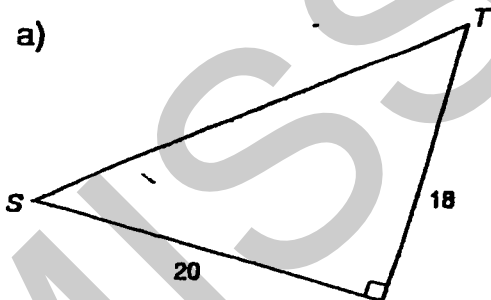
3. Find the lengths of the following segments:

- \overline{EF}
- \overline{DE}
- \overline{DF}

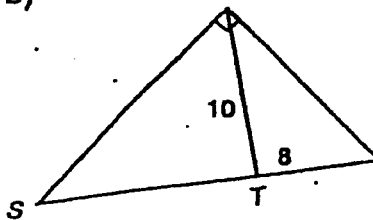


4. Calculate the measure of segment ST in each of the following figures:

a)



b)



5. In a right triangle, the altitude drawn to the hypotenuse divides it into two segments whose measures are 9 cm and 16 cm respectively.

- Draw the diagram.
- Find the perimeter of this triangle.