Ratu Navula College

Year 12 Mathematics Lesson Notes – Week 3

Strand 4: Coordinate Geometry **Sub Strand 4.1: Application of Coordinate Geometry**

Lesson 50: Perpendicular Lines

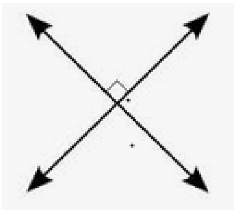
Learning Outcome: able to identify a perpendicular line and find the gradient of the line

Two lines are **perpedicular** if :

- The product of their gradient is -1.

$$m_1 \times m_2 = -1$$

$$m_2 = \frac{-1}{m_1}$$



- They meet at right angles. [intersect at 90°]

Example 1

Find the equation of the line that passes through the point (2, 4) and is perpendicular $to\ y = 3x - 2$.

Let the equation of the line be $y = mx + b$.
Now the gradient of $y = 3x - 2$ is 3.

$\therefore m = -\frac{1}{3}$ (since $-\frac{1}{3} \times 3 = -1$)

$\therefore y = -\frac{1}{3}x + c$

$4 = -\frac{1}{3}(2) + c$ [since (2, 4) lies on line]

$4 = -\frac{2}{3} + c$

$\therefore c = 4\frac{2}{3}$

$\therefore$ The equation of the line is $y = -\frac{1}{3}x + 4\frac{2}{3}$.

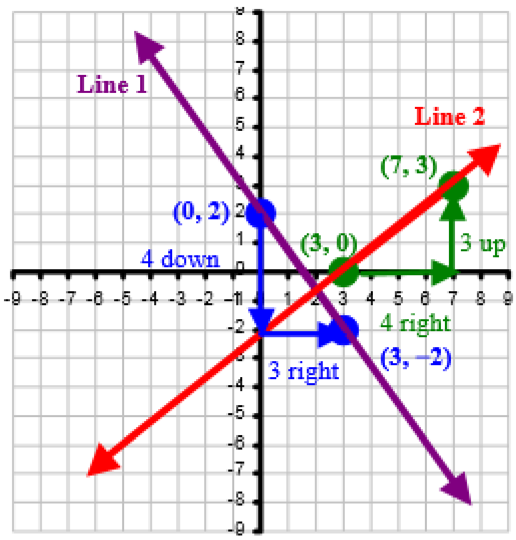
Example 2

Find the equation of the perpendicular bisector of the line joining the points (0, −4) and (6, 5).
(A bisector is a line that crosses another line at right angles and cuts it into two equal lengths.)

THINK	WRITE
1 Find the gradient of the line joining the given points by applying the formula. $m = \frac{y_2 - y_1}{x_2 - x_1}$.	Let $(0, -4) = (x_1, y_1)$. Let $(6, 5) = (x_2, y_2)$. $m_1 = \frac{y_2 - y_1}{x_2 - x_1}$ $m_1 = \frac{5 - (-4)}{6 - 0}$ $= \frac{9}{6}$ $= \frac{3}{2}$
2 Find the gradient of the perpendicular line. $m_1 \times m_2 = -1$	$m_1 = \frac{3}{2}$ $m_2 = -\frac{2}{3}$
3 Find the midpoint of the line joining the given points. $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ where $(x_1, y_1) = (0, -4)$ and $(x_2, y_2) = (6, 5)$.	$x = \frac{x_1 + x_2}{2} = \frac{0 + 6}{2} = 3$ $y = \frac{y_1 + y_2}{2} = \frac{-4 + 5}{2} = \frac{1}{2}$ Hence $(3, \frac{1}{2})$ are the coordinates of the midpoint.
4 Find the equations of the line with gradient $-\frac{2}{3}$ that passes through $(3, \frac{1}{2})$.	Since $y - y_1 = m(x - x_1)$, then $y - \frac{1}{2} = -\frac{2}{3}(x - 3)$
5 Simplify by removing the fractions. Multiply both sides by 3. Multiply both sides by 2.	$3(y - \frac{1}{2}) = -2(x - 3)$ $3y - \frac{3}{2} = -2x + 6$ $6y - 3 = -4x + 12$ $4x + 6y - 15 = 0$

Example 3

Find the equation of a line perpendicular to $4x + 3y - 6 = 0$ and having the same x- intercept as the line $3x - 2y - 9 = 0$



Line 1:

$3y = -4x + 6 \qquad y = \frac{-4x + 6}{3} \qquad y = \frac{-4}{3}x + 2 \quad m_1 = \frac{-4}{3}$

Line 2:

$m_2 = \frac{3}{4}$ (perpendicular lines – negative reciprocal of m_1)

To find x-intercept of $3x - 2y - 9 = 0$, we let $y = 0$.
$3x - 2(0) - 9 = 0 \qquad 3x = 9 \qquad x\text{-int} = 3$ means **(3, 0)**

Using (3, 0) as (x, y) and the form $y = mx + b$, we have:

$(0) = \frac{3}{4}(3) + b$

$0 = \frac{9}{4} + b$

$b = \frac{-9}{4}$

$y = \frac{3}{4}x - \frac{9}{4}$

Class Activity 50

1. Which of the following lines are perpendicular to $y = 2x$?
    a) $y = 3x$
    b) $y = 2x - 3$
    c) $x + 2y = 4$

2. Find the equation of the line that has y-intercept 5 and is perpendicular to $y = -x + 1$

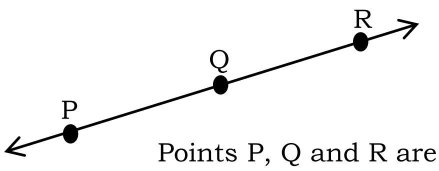
3. A line has a y-intercept of 1·5 and is perpendicular to the line $y = -2x + 1$. Find the equation of the line.

Strand 4: Coordinate Geometry **Sub Strand 4.1: Application of Coordinate Geometry**

Lesson 51: Collinear Points

Learning Outcome: Able to find the gradient of collinear point and find the unknown if one point is missing.

- Collinear points are points which lie on the same line.
- The best method of **proving** that points are collinear is to find the gradient between two points and compare the gradient between other points.
- Same gradient means the points are collinear.



Points P, Q and R are collinear.

Example 1

Show that the points A (2, 0), B (4, 1) and C (10, 4) are collinear.

THINK	WRITE
1 Find the gradient of AB.	Let A (2, 0) $= (x_1, y_1)$ and B (4, 1) $= (x_2, y_2)$ Since $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{AB} = \frac{1-0}{4-2} = \frac{1}{2}$
2 Find the gradient of BC.	Let B (4, 1) $= (x_1, y_1)$ and C (10, 4) $= (x_2, y_2)$ $m_{BC} = \frac{4-1}{10-4} = \frac{3}{6} = \frac{1}{2}$
3 Show that A, B and C are collinear.	Since $m_{AB} = m_{BC} = \frac{1}{2}$ and B is common to both line segments, A, B and C are collinear.

Class Activity 51

Show that the points A $(0, -2)$, B 15, 12 and C $(-5, -5)$ are collinear.

Additional notes

STRAND 4: COORDINATE GEOMETRY

1. **Calculate distance, midpoint and gradient**

a) A diameter of a circle intersects the circumference of a circle at the points (-3,3) and (1,0). Find the
   i)length of the diameter
   ii) length of the radius
   iii)coordinates of the center of the circle
vii) Calculate the **gradient** of the diameter

Sau ni taro

Length (E ke e vakayagataki kina na distance formula)

i)$d = \sqrt{[(x2 - x1)^2 + (y2 - y1)^2}$ *(oqo na distance formula)*

$d = \sqrt{[(-3 - 1)^2 + (3 - 0)^2}$ *(Plug in takin a velu ni x1,y1,x2,y2)*

$d = \sqrt{[16 + 9}$ *(square root taki)*

d = 5

ii) length of the radius = ½(d) =1/2(5) = 2.5 *(Na length ni radius e veimama ni diameter)*

iii) Center of circle= mid -point $\frac{x1+x2}{2}, \frac{y1+y2}{2}$ *(E vakayagataki e kena mid-point formula)*

$\frac{-3+1}{2}, \frac{3+0}{2}$

$(-1, 1.5)$

$iv)$ gradient or slope $m = \frac{y2-y1}{x2-x1}$ *(E ke e vakayagataki kina na gradient formula)*

$m = \frac{3-0}{-3-1}$, $m = \frac{3}{-4}$

3. **Determine the relationship between gradient of a line and the angle it makes with the positive x –axis.**

a) Find the equation of the line passing through the point (0,-4) which makes an angle of 135^0 with the positive x-axis.

Sau ni Taro

Gradient, m = tanØ, m = tan 135, m= -1 *(E ke e vaqarai I liu na gradient)*

One point gradient equation, y-y1= m(x -x1) *(Vakayagataki na one point gradient formula)*

y- -4 = -1(x -0) *(Plug takin a velu ni y1 kei na x1)*

y + 4 = -x

<u>y = -x – 4</u>

4. **Determine the equation of a line**.

Find the equation of the line which pass points A(-2,2) and C(6,-4)

$\frac{y-y1}{x-x1} = \frac{y2-y1}{x2-x1}$ *(E vakayagataki e ke na two-point equation)*

$\frac{y-2}{x--2} = \frac{-4-2}{6--2}$ *(plugtaki na x kei na y velu)*

$\frac{y-2}{x+2} = -0.75$ *(solve takin a yasana I matau)*

$\frac{y-2}{} = -0.75(x+2)$ *(x mai na x+2 kina yasana I matau)*

$\frac{y-2}{} = -0.75x - 1.5$*(solvetaki na yasana I matau)* *y=-0.75x -0.5*

5. **Solve problems involving parallel and perpendicular lines.**

a) For what value of p will the line 2x + py = 6

i) parallel to the line $y = \frac{x}{5} + \frac{4}{5}$

ii) Perpendicular to the line y = -2x + 2

Sau ni Taro

i)make y the subject

py=6-2x

y=$\frac{6-2x}{p}$ *(E ke e caka I liu me subject ni formula na y)*

y=$\frac{6}{p} - \frac{2x}{p}$ (Qo sa volai kina I tuvatuva na y = c -mx)

gradient m = $\frac{-2}{p} = \frac{1}{5}$ *(Sa qai caka me rau tautauvata na gradient na cross multiply)*

-10= p

ii)For perpendicular lines $m2 = -\frac{1}{m1}$ *(Qo na gradient ni perpendicular lines)*

$m2 = -\frac{1}{-2}$, m2 = 0.5

$-\frac{2}{p} = 0.5$*(rau caka merau tautauvata na gradient)*

$\frac{2}{-0.5} = p$

$-4 = p$

6. **Determine collinear points.**

Test whether points A= (1,2) ,B= (2, 4), and C= (3, 6) are collinear.

Sau ni Taro

Collinear points are points which lie on the same line.

Gradient of AB = Gradient of BC *(gradient era una equal)*

$\frac{y2-y1}{x2-x1} = \frac{y2-y1}{x2-x1}$ *(qo na equation ni gradient)*

$\frac{4-2}{2-1} = \frac{6-4}{3-2}$ *(Plug taki na velu ni x kei na y)*

2 = 2   *(Ke rau tautauvata e collinear ke rau duidui e seg ani collinear)*

(Since gradient equal than points A,B and C are collinear)

Strand 5: Trigonometry **Sub Strand 5.1: Non- right angled triangle**

Lesson 52: Trigonometry Rules

Learning outcome: Find the unknown angle using SOH/CAH/TOA

What is a Pythagorean Theorem?

In a right triangle, the side opposite the right angle is called the **hypotenuse**, and the other two sides are called its **legs**. For example, in Figure 1.1.4 the right angle is C, the hypotenuse is the line segment $\overline{AB}$, which has length c, and $\overline{BC}$ and $\overline{AC}$ are the legs, with lengths a and b, respectively. The hypotenuse is always the longest side of a right triangle (see Exercise 11).

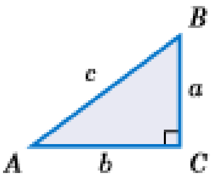


Figure 1.1.4

By knowing the lengths of two sides of a right triangle, the length of the third side can be determined by using the **Pythagorean Theorem**:

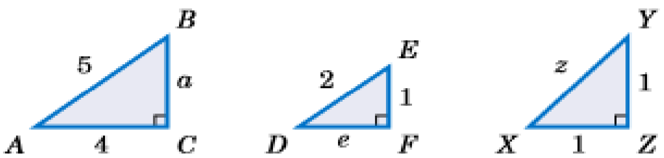
Theorem 1.1. Pythagorean Theorem: The square of the length of the hypotenuse of a right triangle is equal to the sum of the squares of the lengths of its legs.

Thus, if a right triangle has a hypotenuse of length c and legs of lengths a and b, as in Figure 1.1.4, then the Pythagorean Theorem says:

$$\boxed{a^2 + b^2 = c^2} \tag{1.1}$$

Example 1

For each right triangle below, determine the length of the unknown side:



Solution: For triangle $\triangle ABC$, the Pythagorean Theorem says that

$$a^2 + 4^2 = 5^2 \quad \Rightarrow \quad a^2 = 25 - 16 = 9 \quad \Rightarrow \quad \boxed{a = 3}.$$

For triangle $\triangle DEF$, the Pythagorean Theorem says that

$$e^2 + 1^2 = 2^2 \quad \Rightarrow \quad e^2 = 4 - 1 = 3 \quad \Rightarrow \quad \boxed{e = \sqrt{3}}.$$

For triangle $\triangle XYZ$, the Pythagorean Theorem says that

$$1^2 + 1^2 = z^2 \quad \Rightarrow \quad z^2 = 2 \quad \Rightarrow \quad \boxed{z = \sqrt{2}}.$$

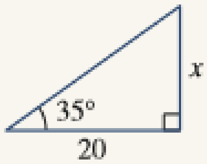
The Three Basic Trigonometric Ratios

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}, \qquad \cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}, \qquad \tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

Students need to learn these definitions thoroughly. One simple mnemonic that might assist them is SOH CAH TOA, consisting of the first letter of each ratio and the first letter of the sides making up that ratio.

Example 2

Find the length of the unknown side x in the triangle shown. Answer correct to three decimal places.

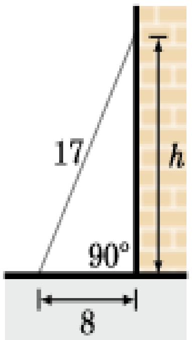


SOLUTION:

1	Identify the sides of the right-angled triangle that are relevant to the question.	The opposite side is the unknown, the adjacent side is 20.
2	Determine the ratio that uses these sides (TOA).	$\tan\theta = \frac{o}{a}$
3	Substitute the known values and x for o.	$\tan 35° = \frac{x}{20}$
4	To make x the subject, multiply both sides of the equation by 20.	$20 \times \tan 35° = x$ $x = 20 \times \tan 35°$
5	Press 20 [tan] 35 [exe] or =.	$= 14.00415076$
6	Write the answer correct to three decimal places.	$= 14.004$

Example 3

A 17 ft ladder leaning against a wall has its foot 8 ft from the base of the wall. At what height is the top of the ladder touching the wall?

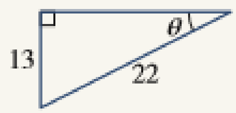


Solution: Let h be the height at which the ladder touches the wall. We can assume that the ground makes a right angle with the wall, as in the picture on the right. Then we see that the ladder, ground, and wall form a right triangle with a hypotenuse of length 17 ft (the length of the ladder) and legs with lengths 8 ft and h ft. So by the Pythagorean Theorem, we have

$$h^2 + 8^2 = 17^2 \Rightarrow h^2 = 289 - 64 = 225 \Rightarrow \boxed{h = 15 \text{ ft}}.$$

Example 4

Find the angle θ in the triangle shown. Answer correct to the nearest minute.



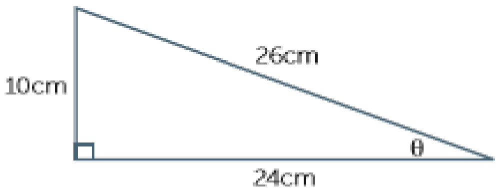
SOLUTION:

1	Identify the relevant sides of the right-angled triangle.	Opposite = 13, hypotenuse = 22
2	Determine the ratio that uses these sides (SOH).	$\sin\theta = \frac{o}{h}$
3	Substitute the known values.	$\sin\theta = \frac{13}{22}$
4	Make θ the subject of the equation.	$\theta = \sin^{-1}\left(\frac{13}{22}\right)$
5	Press SHIFT [$\sin^{-1}$] (13 ÷ 22) [exe] or =. or Press SHIFT [$\sin^{-1}$] 13 [$a^{b/c}$] 22 [exe] or =.	$= 36.22154662$
6	Convert decimal degrees to degrees and minutes using [° ′ ″] or [DMS] on your calculator.	$= 36°13'$
7	Write the answer correct to the nearest minute.	

Example 5

For the following triangle, write down the value of:

a $\sin\theta$ **b** $\cos\theta$ **c** $\tan\theta$



SOLUTION

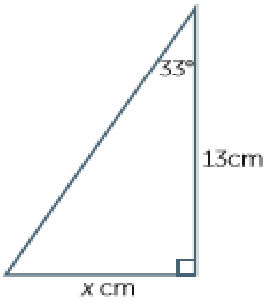
a $\sin\theta = \dfrac{\text{opposite}}{\text{hypotenuse}} = \dfrac{10}{26} = \dfrac{5}{13}$

b $\cos\theta = \dfrac{\text{adjacent}}{\text{hypotenuse}} = \dfrac{24}{26} = \dfrac{12}{13}$

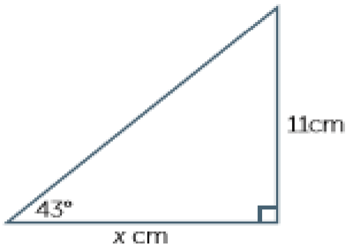
c $\tan\theta = \dfrac{\text{opposite}}{\text{adjacent}} = \dfrac{10}{24} = \dfrac{5}{12}$

Example 6

a Find the length marked *x* in the diagram below, correct to two decimal places.



b Find *x*, correct to two decimal places



SOLUTION

a $\tan 33° = \dfrac{x}{13}$

Hence $x = 13\tan 33°$

≈ 8.44

b $\tan 43° = \dfrac{11}{x}$

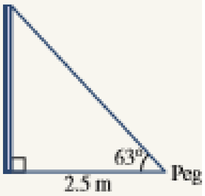
Hence $x\tan 43° = 11$

so $x = \dfrac{11}{\tan 43°}$

≈ 11.80

Example 7

A vertical tent pole is supported by a rope tied to the top of the pole and to a peg on the level ground. The peg is 2.5 m from the base of the pole and the rope makes an angle of 63° to the horizontal. What is the length of the rope between the peg and the top of the tent pole? Answer correct to two decimal places.



SOLUTION:

1 Identify the unknown side and call it x, and identify the relevant sides of the right-angled triangle. — Adjacent is 2.5 m, hypotenuse is the unknown x.

2 Determine the ratio that uses these sides (CAH). — $\cos\theta = \frac{a}{h}$

3 Substitute the known values, and x for h. — $\cos 63^\circ = \frac{2.5}{x}$

4 Multiply both sides of the equation by x. — $x\cos 63^\circ = 2.5$

5 Divide both sides of the equation by cos 63°, so x is now the subject of the equation. — $x = \frac{2.5}{\cos 63^\circ}$

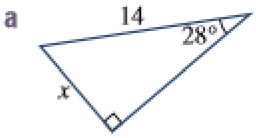
6 Press 2.5 ÷ [cos] 63 [exe] or =. — $= 5.506723161$

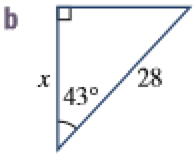
7 Write the answer correct to two decimal places. — $= 5.51$

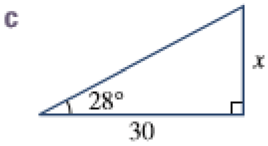
8 Write the answer in words. — Length of the rope is 5.51 m.

Class Activity 52

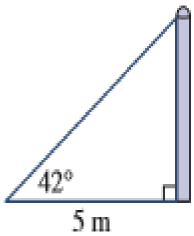
1. Find the length of the unknown side x in each triangle, correct to two decimal places.



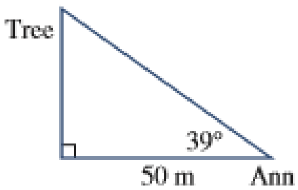




2. A pole is supported by a wire that runs from the top of the pole to a point on the level ground 5 m from the base of the pole. The wire makes angle of 42° with the ground. Find the height of the pole, correct to two decimal places.



3. Ann noticed a tree was directly opposite her on the far bank of the river. After she walked 50 m along the side of the river, she found her line of sight to the tree made an angle of 39° with the river bank. Find the width of the river, to the nearest metre.



Strand 5: Trigonometry **Sub Strand 5.1: Non- Right Angle Triangle**

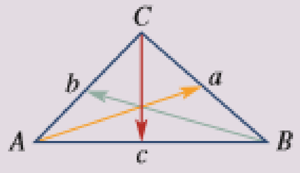
Lesson 53: The Sine Rule

Learning Outcome: Able To Use Sine Rule To Find The Unknown Angles.

THE SINE RULE

Sine rule relates the sides and angles in a triangle.

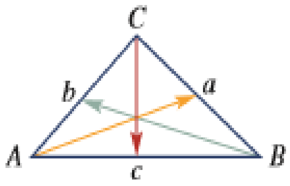
- To find a side, use $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$
- To find an angle, use $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$



Sine rule is used in a non-right-angled triangle given:

- two sides and an angle opposite one of the given sides, or
- two angles and one side.

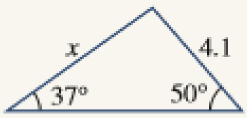
Trigonometry is also applied to non-right-angled triangles. The sides of the triangle are named according to the opposite angle.



- Side a is opposite angle A.
- Side b is opposite angle B.
- Side c is opposite angle C.

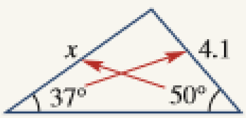
Example 1

Find the value of x, correct to one decimal place.



SOLUTION:

1 Check that the sides and angles are opposite each other.



2 Write the sine rule to find a side.

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

3 Substitute the known values ($a = x$, $A = 50$, $b = 4.1$ and $B = 37$).

$$\frac{x}{\sin 50^\circ} = \frac{4.1}{\sin 37^\circ}$$

4 Multiply both sides of the equation by $\sin 50^\circ$.

$$x = \frac{4.1 \times \sin 50^\circ}{\sin 37^\circ}$$

5 Evaluate.

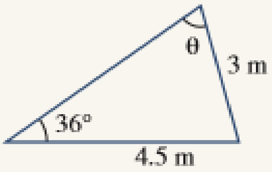
$$= 5.218849806$$

6 Write the answer correct to one decimal place.

$$= 5.2$$

Example 2

Hannah is standing 4.5 m from the base of a 3 m sloping wall. The angle of elevation to the top of the wall is 36°. Find the angle θ at the top of the wall, to the nearest minute.

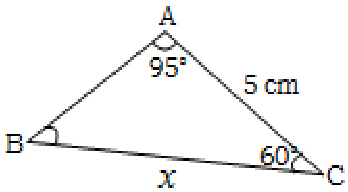


SOLUTION:

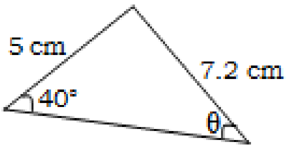
1. Check that the sides and angles are opposite each other.
2. Write the sine rule to find an angle. $\dfrac{\sin A}{a} = \dfrac{\sin B}{b}$
3. Substitute the known values ($a = 4.5$, $A = \theta$, $b = 3$ and $B = 36$). $\dfrac{\sin \theta}{4.5} = \dfrac{\sin 36°}{3}$
4. Multiply both sides of the equation by 4.5. $\sin \theta = \dfrac{4.5 \times \sin 36°}{3}$
5. Evaluate. $= 0.881\,677\,8784$
6. Write the answer correct to the nearest minute. $\theta = 61°51'$
7. Write the answer in words. The angle at the top of the wall is 61°51′.

Class Activity 53

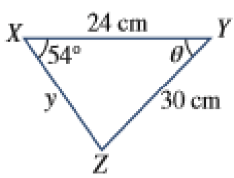
1. Find the length of the side marked *x*.



2. Find the size of the angle marked θ.



3. Triangle XYZ has sides $YZ = 30$cm, $XY = 24$cm and $\angle YXZ = 54°$.
   Use the sine rule to:
   a Find the size of angle XYZ. Give your answer to the nearest degree.
   b Find the size of y. Give your answer to the nearest centimetre.



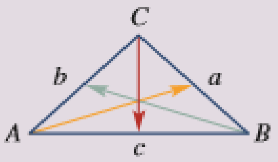
Strand 5: Trigonometry **Sub Strand 5.1: Non- Right Angle Triangle**

Lesson 54: The Cosine Rule

Learning Outcome: Able To Use Cosine Rule To Find The Unknown Angles.

THE COSINE RULE

To find the third side given two sides and the included angle in ΔABC,



$a^2 = b^2 + c^2 - 2bc \cos A$ (a is opposite $\angle A$)

$b^2 = a^2 + c^2 - 2ac \cos B$ (b is opposite $\angle B$)

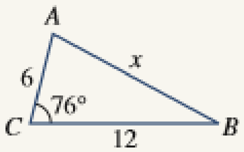
$c^2 = a^2 + b^2 - 2ab \cos C$ (c is opposite $\angle C$)

To find an angle given three sides (rearrangements of the above formulas):

$\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$ $\cos B = \dfrac{a^2 + c^2 - b^2}{2ac}$ $\cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$

Example 1

Find the value of x, correct to two decimal places.

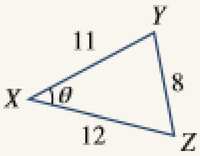


SOLUTION:

1. Write the cosine formula to find a side. $c^2 = a^2 + b^2 - 2ab \cos C$
2. Substitute the values for a, b, c and C. $x^2 = 12^2 + 6^2 - 2 \times 12 \times 6 \times \cos 76°$
3. Calculate the value of x^2. $x^2 = 145.163247$
4. Take the square root of both sides. $x = 12.05$

Example 2

Find the value of the angle θ. Answer in degrees, correct to one decimal place.

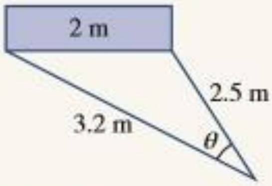


SOLUTION:

1. Write the cosine formula to find an angle. $\cos X = \dfrac{y^2 + z^2 - x^2}{2yz}$
2. Substitute the values for x, y, z and X ($x = 8$, $y = 12$, $z = 11$ and $X = \theta$). $\cos \theta = \dfrac{(12^2 + 11^2 - 8^2)}{(2 \times 12 \times 11)}$
3. Calculate the value of $\cos \theta$. $\cos \theta = 0.7613636364$
4. Use your calculator to find θ. $\theta = 40.41543902$
5. Write the answer correct to one decimal place. $= 40.4°$

Example 3

Samuel shoots for goal when he is 2.5 m from one post and 3.2 m from the other post. The goal is 2 m wide. What is the size of the angle θ for Samuel to score a goal? Answer correct to the nearest minute.

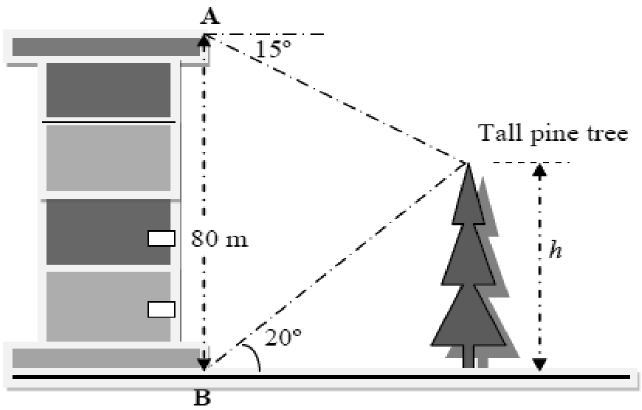


SOLUTION:

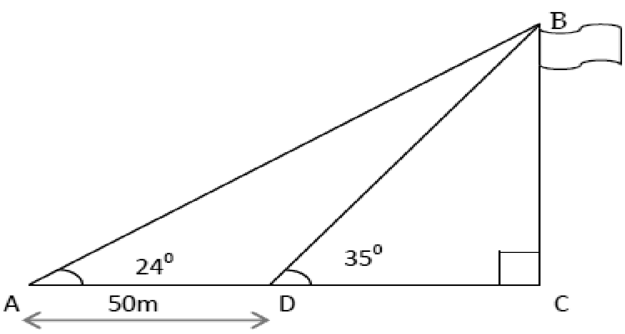
1. Write the cosine formula to find an angle. $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$
2. Substitute the values for a, b, c and A ($a = 2$, $b = 2.5$, $c = 3.2$ and $A = \theta$). $\cos\theta = \dfrac{(2.5^2 + 3.2^2 - 2^2)}{(2 \times 2.5 \times 3.2)}$
3. Calculate the value of $\cos\theta$. $\cos\theta = 0.780625$
4. Use your calculator to find θ. $\theta = 38.68216452°$
5. Use your calculator to convert decimal degrees to degrees and minutes. $= 38°41'$
6. Write the answer in words. The size of the angle for Samuel to score a goal is $38°41'$.

Class Activity 54

1. When the top of a tall pine tree is viewed from the top of a four-storey building (point **A**) 80 m above the ground, the angle of depression is equal to 15º and when it is viewed from point **B** on the ground, the angle of elevation is 20º. If points **A** and **B** are on the same vertical line, find ***h***, the height of the tall pine tree. (diagram is not drawn to scale)



2. The diagram below shows 2 angles of elevation of the flagpole, 24˚ and 35˚ at points A and D respectively. If point D is 50m from point A, find the distance $\overline{AB}$.



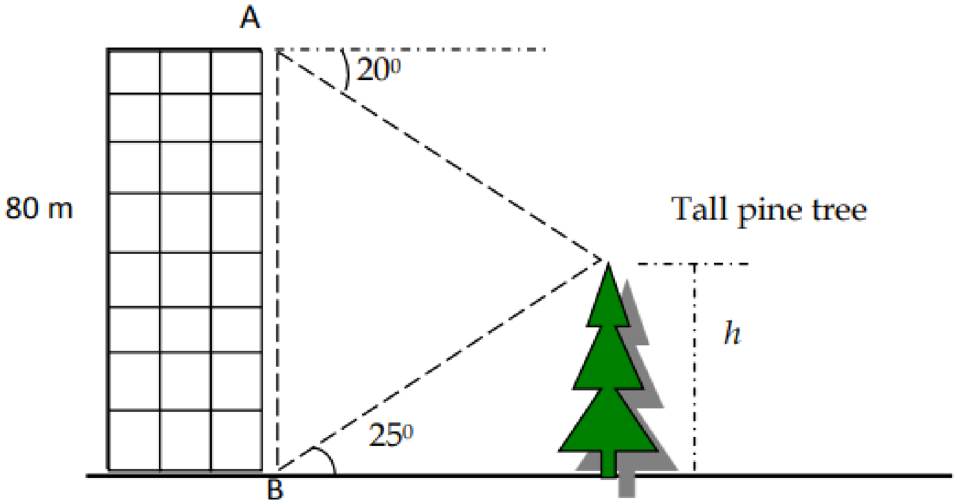
RATU NAVULA COLLEGE

YEAR 12 MATHEMATICS - WORKSHEET 3

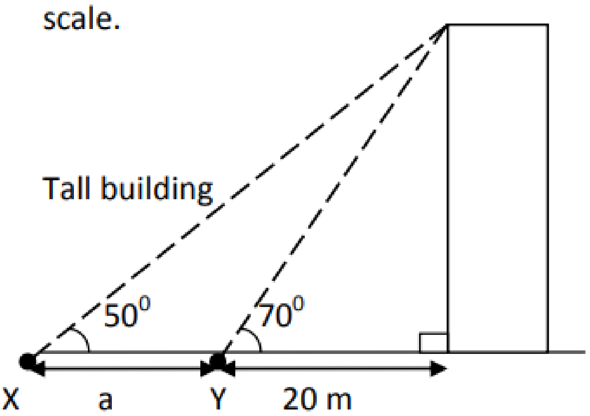
Strand 5: Trigonometry **Sub Strand 5.1: Non- Right Angle Triangle**

1. A private plane flies 1.3 hours at 110 mph on a bearing of 40°. Then it turns and continues another 1.5 hours at the same speed, but on a bearing of 130°. At the end of this time, how far is the plane from its starting point? What is its bearing from that starting point?

2. When the top of a tall pine tree is viewed from the top of a 8 – storey building (point A) 80 m above the ground, the angle of depression $= 20^0$ and when it is viewed from point B on the ground, the angle of elevation $= 25^0$. If points A and B are on the same vertical line, find h, the height of the tall pine tree. (Diagram not to scale)



3. Rajjie is stationed at a Point Y, 20 m from the base of a tall building. He looks up to the top of the building at an angle of 70^0. Diagram not to scale.



a) How high is the building?

b) Rajjie then moves back some distance so that he stands at Point X and now looks to the top of the building at an angle of 50^0. Calculate the distance 'a'.