Earthquake hits Newcastle: Eyewitness account

Name: _____ **Date:**_____

On Thursday 28 December 1989, an earthquake hit the city of Newcastle. Eyewitness reports from the area have estimated that the area shook for around five seconds and caused extensive damaged to buildings in the area.

Local authorities have confirmed that over 40,000 buildings have been damaged or destroyed. Shopkeepers and residents have been shocked by the damage caused, with many buildings showing signs of minor damage and others with severe damage. Some residents stated that their neighbourhoods looked like a cyclone had hit it but most tuned into local radio stations to find out the real cause of the destruction.

One shopkeeper was saddened to report that most of the damage seemed to be to older buildings, some of which were over 100 years old, with a long history in the community.

A resident has told how she was talking to a friend and all of a sudden felt the ground shaking with glassware and crockery rattling and falling off the shelves. Other residents have commented on how cracks started to appear in the walls of their homes.

Despite the extensive damage to buildings, major infrastructure, such as railway tracks and telephone lines were not badly damaged.

A local seismologist has reported that the earthquake measured 5.6 on the Richter scale. He has also commented that Australia experiences strong earthquakes like these around every 18 months but they rarely happen in populated areas and have little effect on people and communities. Because this particular earthquake hit a city with buildings and infrastructure, it was estimated to have caused about $4 billion damage.

Members of nearby towns have reported to have felt the shaking, with scientists confirming that the shaking was felt up to 600 kilometres away from the epicentre of the earthquake.

Question placemat

Newcastle earthquake

Name:_____

Date:_____

What?

Where?

When?

Who?

Why?

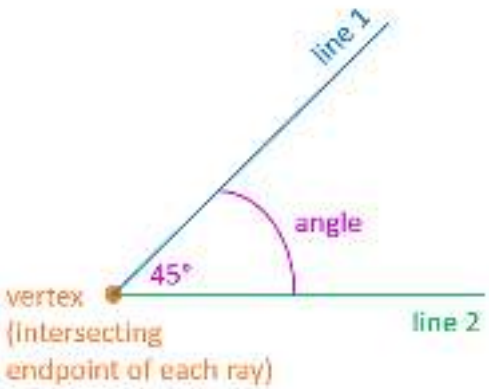
Identifying Angles

What are angles?

Two straight lines (also known as rays) that share the same endpoint form an angle.

The point where two straight lines intersect is called the vertex.

The two lines form the sides of the angle.



The space between the two lines is called the angle.

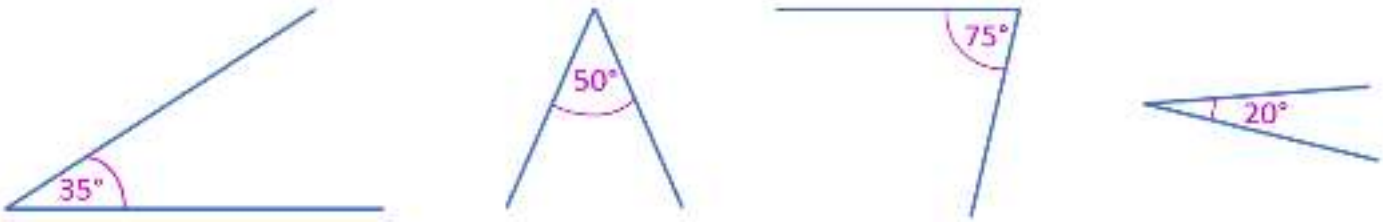
The angle size changes, depending on the amount of turn of each line.

The size of an angle is measured in degrees (°).

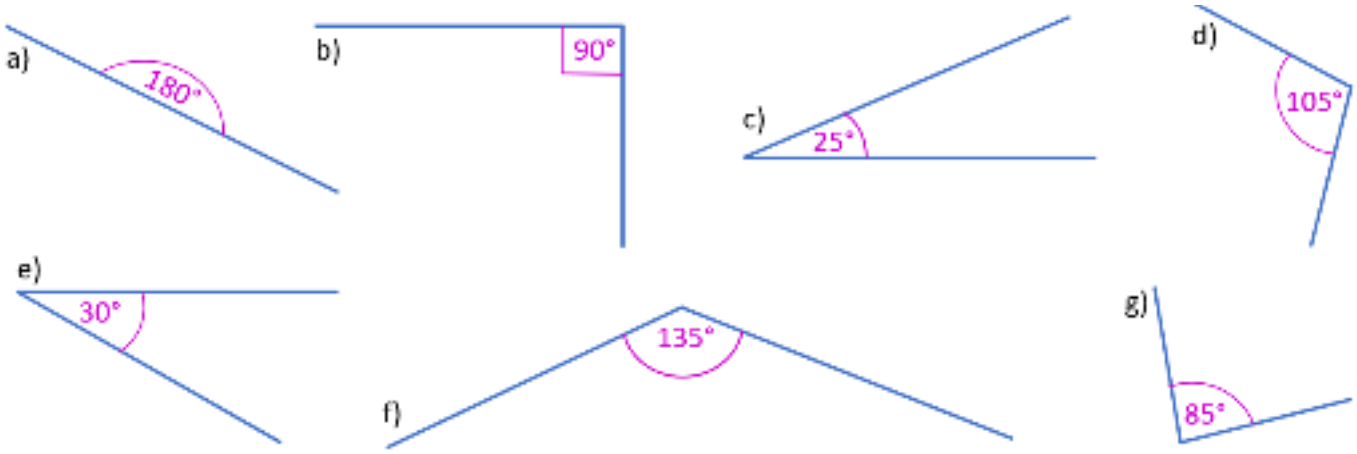
Acute Angles:

Acute angles are small angles, measured internally between two straight lines.
An acute angle is more than 0° but less than 90°.

All the angles below are acute angles.



Question 1: Which of the following angles are ACUTE ANGLES? Circle all ACUTE ANGLES below.

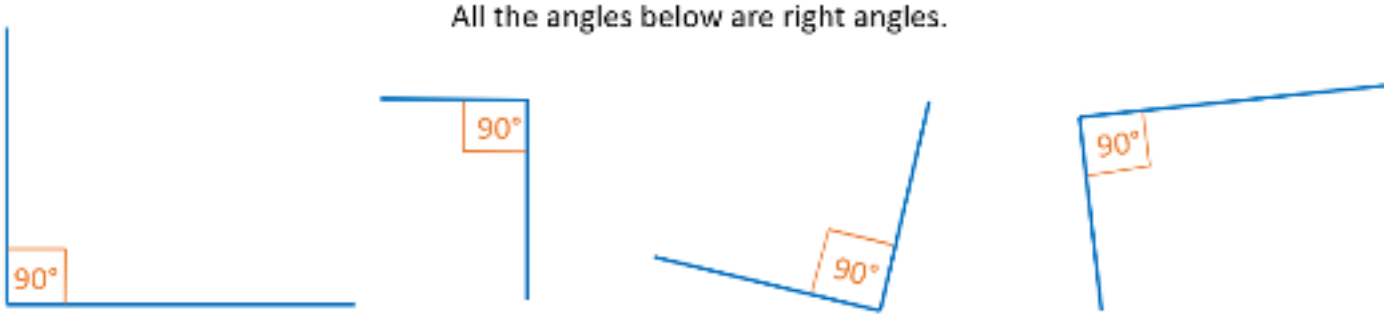


Question 2: Can you find any ACUTE ANGLES in the bicycle picture? Colour in any ACUTE ANGLES you find.

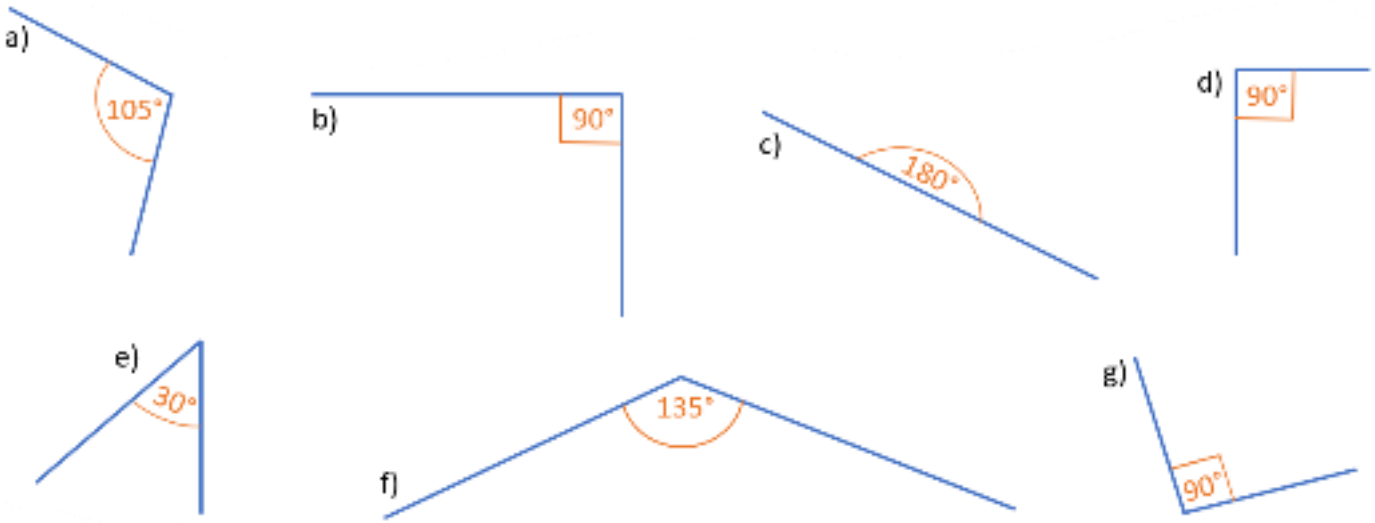
Right Angles:

Right angles have a special box-like symbol.
A right angle is equal to 90°.

All the angles below are right angles.



Question 3: Which of the following angles are RIGHT ANGLES? Circle all RIGHT ANGLES below.



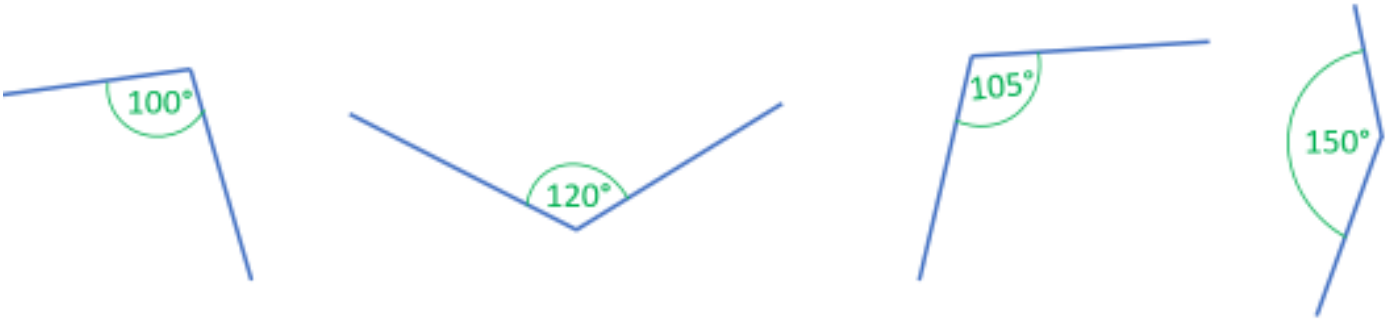
Numeracy – Monday, 11th October - Measurement and Geometry - Geometric Reasoning

Obtuse Angles:

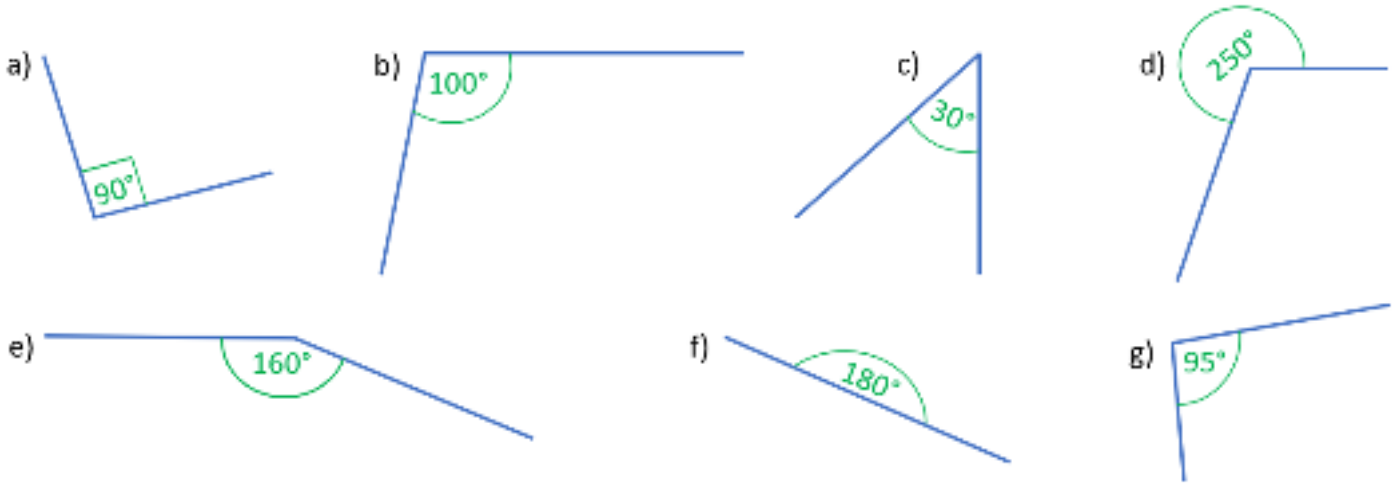
Obtuse angles are larger than right angles. They are measured internally between two straight lines.

An obtuse angle is more than 90° but less than 180°.

All the angles below are obtuse angles.



Question 4: Which of the following angles are OBTUSE ANGLES? Circle all OBTUSE ANGLES below.



Straight Angle:

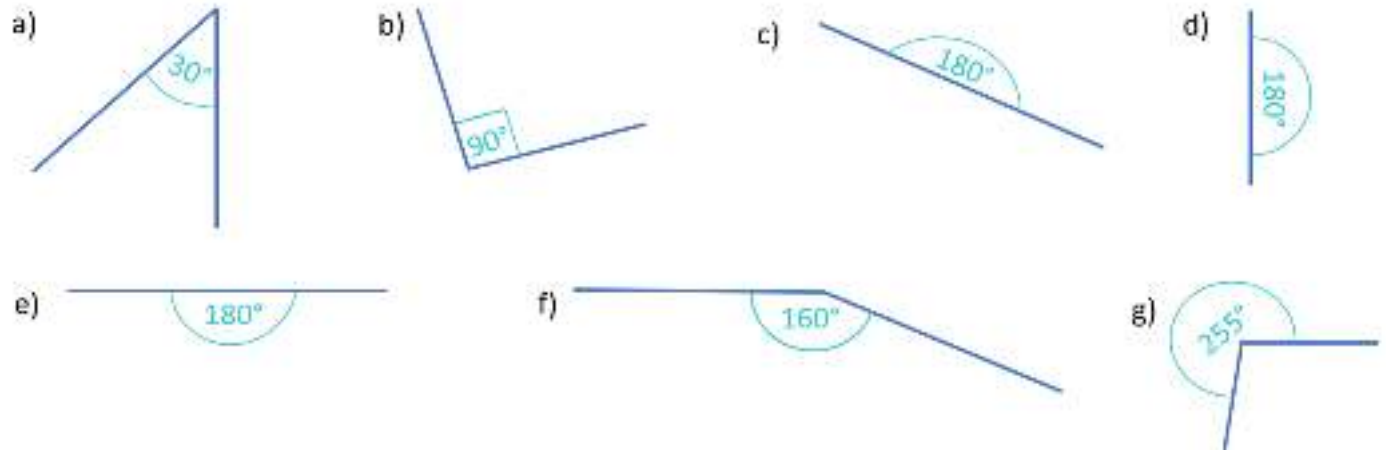
A straight angle looks like one straight line.

A straight angle is equal to 180°.

All the angles below are straight angles.

Numeracy – Monday, 11th October - Measurement and Geometry - Geometric Reasoning

Question 5: Which of the following angles are STRAIGHT ANGLES? Circle all STRAIGHT ANGLES below.



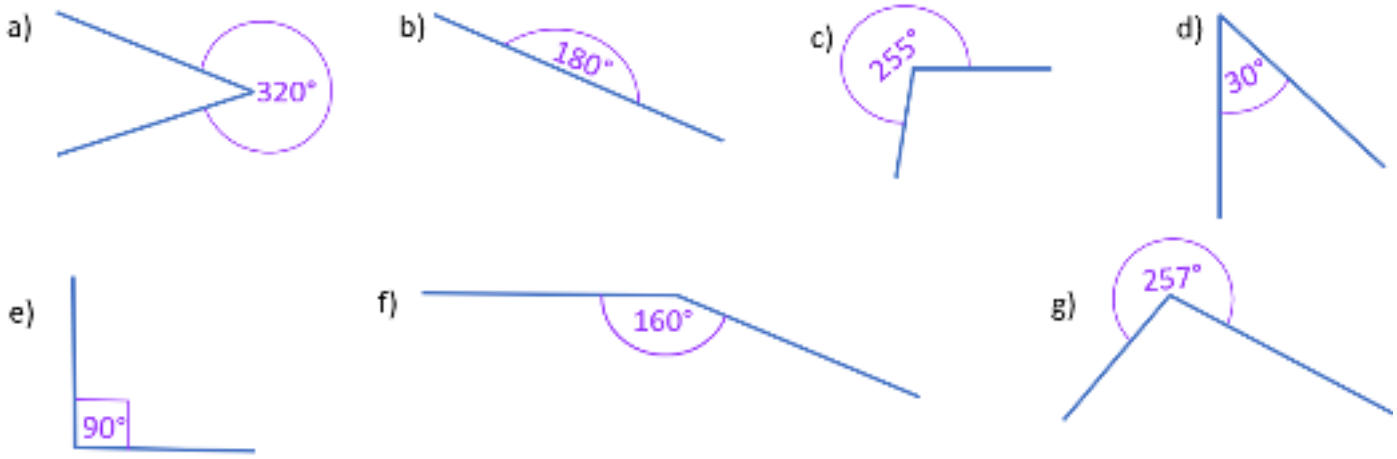
Reflex Angles:

Reflex angles are large angles, measured externally between two straight lines.

A reflex angle is more than 180° but less than 360°.

All the angles below are reflex angles.

Question 6: Which of the following angles are REFLEX ANGLES? Circle all REFLEX ANGLES below.



Question 7: Draw an acute, a right, an obtuse, a straight and a reflex angle, and label them.

Reporting earthquakes

The energy released at the origin of an earthquake is converted into seismic waves (seismic comes from 'seismo', meaning earthquake), which travel in all directions away from the source. It is when these seismic waves reach the Earth's surface that an earthquake is felt. The area where an earthquake is recorded is not necessarily where it originated. If an earthquake occurs far below ground, the seismic waves released can dissipate as they travel through the Earth. This results in less shaking than from an earthquake of the same magnitude that occurs closer to the surface. Two fundamentally different but equally important types of scale are commonly used to describe earthquakes. The amount of energy released by an earthquake and converted into seismic waves is measured on a magnitude scale, for example, the Richter scale, while the intensity of shaking occurring at any given point on the Earth's surface is measured on an intensity scale, for example, the Modified Mercalli scale. Ideally, there is only one measure of magnitude for any given earthquake but many different intensities, as the effects of an earthquake depend on the area where it is measured. An earthquake in a city will have a greater effect on humans and infrastructure than an earthquake in an uninhabited area with no roads or buildings.

The Richter scale

The Richter scale is one way to measure the magnitude of an earthquake (the amount of energy released). The Richter scale is calculated by taking logarithms of the height of the seismic waves recorded by the seismograph. This means that a whole-number jump on the Richter scale indicates a tenfold increase in the amplitude of the seismic waves, for example, an earthquake measuring level six on the Richter scale has amplitudes ten times greater than a level five earthquake. Only a percentage of the energy released during an earthquake event is converted into seismic waves. A unit increase in magnitude is equal to a 32-fold increase in the actual energy released by the earthquake. The rest of the energy goes into processes such as heating and deforming rocks. The Richter scale is considered objective because it is based on recordings and measurements. The magnitude does not depend on the area where it is measured, making it a direct characterisation of the earthquake event.

The Modified Mercalli scale

The Modified Mercalli scale is used to measure the intensity of, or destruction caused by, an earthquake. Damage caused by earthquakes can vary from area to area depending on the composition of the ground and the design of structures surrounding the earthquake-affected area. The Modified Mercalli scale uses Roman numerals and is based on people's subjective interpretations. Modified Mercalli scale levels are determined after assessments of the damage are done and witnesses interviewed. An earthquake of low magnitude can rate highly on the Modified Mercalli scale if it hits an area with unstable buildings and causes extensive damage. Based on interpretations and personal observations, this scale is considered subjective. It describes the effect of the earthquake, which depends on the position of the epicentre of the earthquake and the spread of the seismic waves. There can be several different Modified Mercalli measures for the same earthquake event that is felt in different areas. The Modified Mercalli scale gives us a measure of how the earthquake affected a location, rather than an indication of how much energy was released.

Earthquake

The Earth's surface is on the move.

In Alaska in 1964, a magnitude 9.2 earthquake jarred the earth so strongly it caused fishing boats to sink in Louisiana. What causes the ground tremble like that? The answer is simple. The Earth's surface is on the move.

Earthquakes cause devastating destruction to buildings around the world.
Earthquakes cause devastating destruction to buildings around the world.
PHOTOGRAPH BY XIEYOUDING, ISTOCKPHOTO

The surface of the earth, called the "crust," is not one solid piece. It's more like a 20 piece puzzle. Each puzzle piece is called a "plate." The plates constantly move. Fortunately for us, they don't move fast. Geologists estimate the fastest plate might shift 6 inches a year (15 centimeters). That's about as fast as your hair grows.

Earthquakes happen when a plate scrapes, bumps, or drags along another plate. When does this happen? Constantly. About a half-million quakes rock the Earth every day. That's millions a year. People don't feel most of them because the quake is too small, too far below the surface, or deep in the sea. Some, however, are so powerful they can be felt thousands of miles away.

A powerful earthquake can cause landslides, tsunamis, flooding, and other catastrophic events. Most damage and deaths happen in populated areas. That's because the shaking can cause windows to break, structures to collapse, fire, and other dangers.

Geologists cannot predict earthquakes. They hope they will in the future through continued research and improved technology.

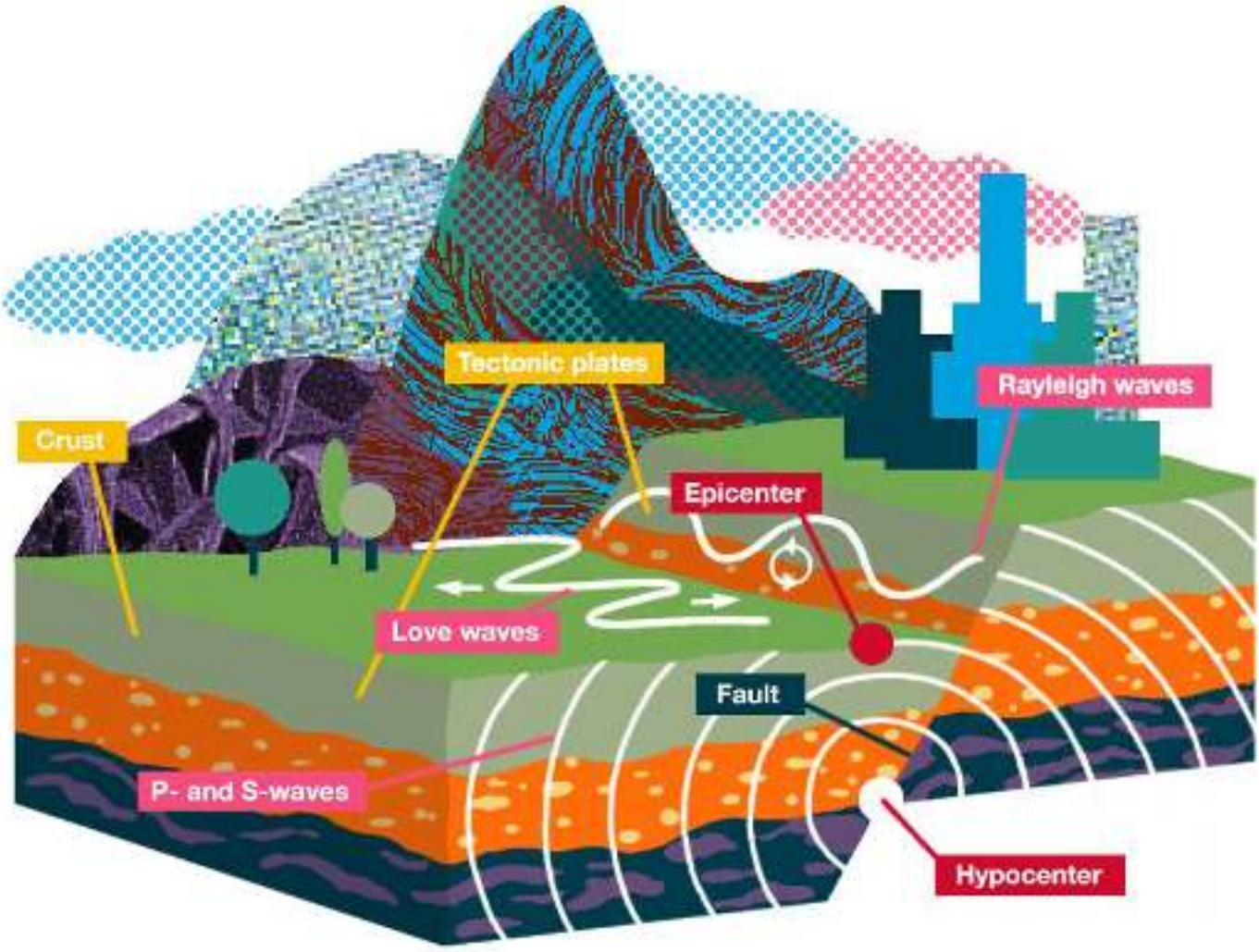
Earthquakes can happen anytime or anywhere. But you can prepare for the unpredictable with a family safety plan, emergency kit, and supplies.

WRITING ORGANIZER - Explanation

Introduction: ***General statement about the topic.***

Explanation: ***- Series of explanatory statements.***

Conclusion: ***- Summary or comment***


Tectonic plates
Crust
Rayleigh waves
Epicenter
Love waves
Fault
P- and S-waves
Hypocenter

Looking for Angles in Letters

Your job today is to get artistic and create and measure angles in a fun way using a protractor.

If you do not have a protractor, there is a printed version in this work booklet that can be cut out and used

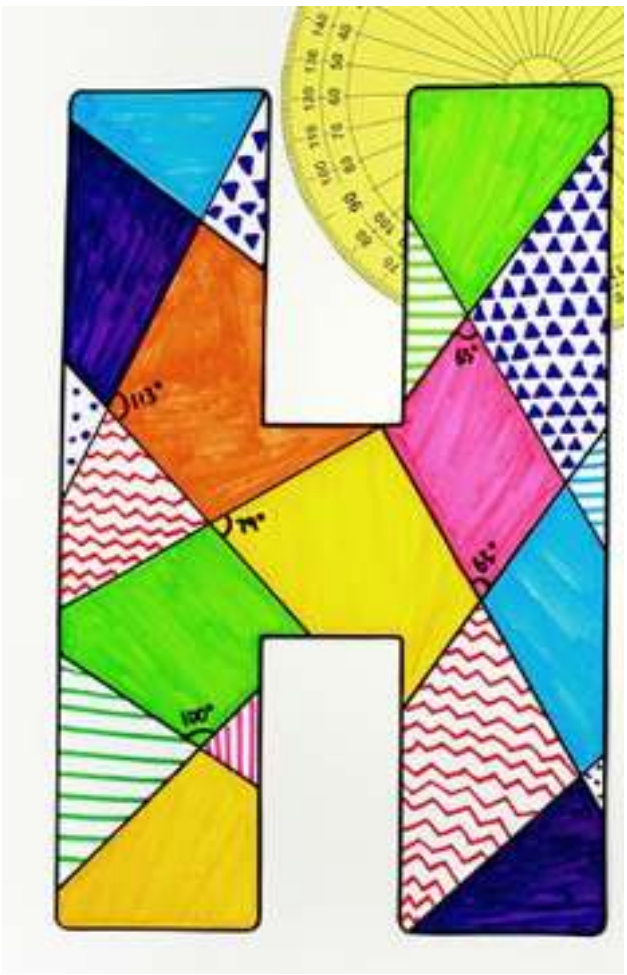
TODAY'S TASK:

Step 1: Using a ruler or straight edge, draw a LARGE block letter version of the first letter of your name. It should take up the A4 page provided.

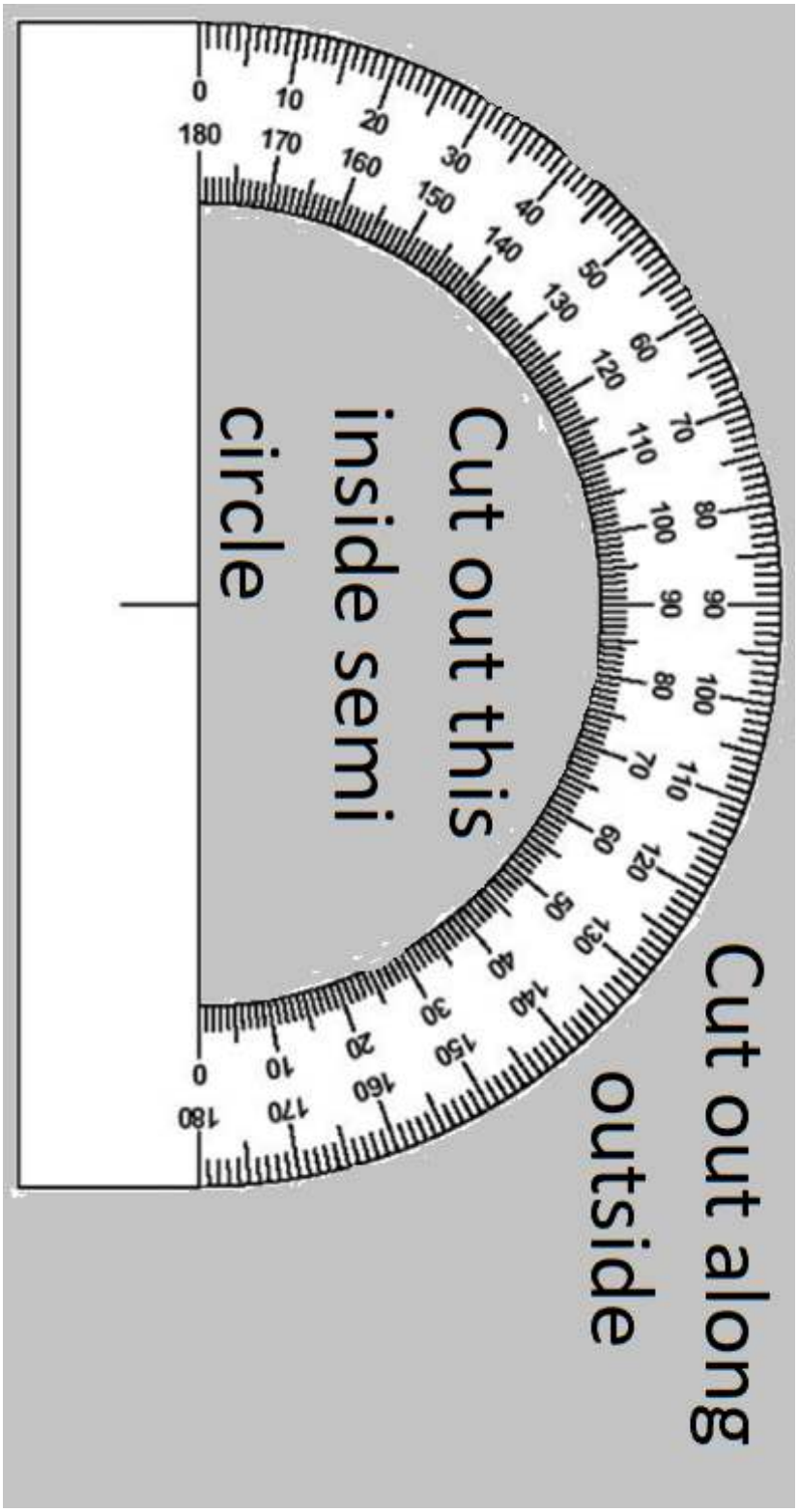
Step 2: Using a ruler or straight edge, rule straight lines that cross over each at random angles inside your block letter.

Step 3: Colour or decorate the areas between the lines that you have created in different artistic ways.

Step 4: Use a protractor to measure the angles you have created with your random lines.



Looking for Angles in Letters

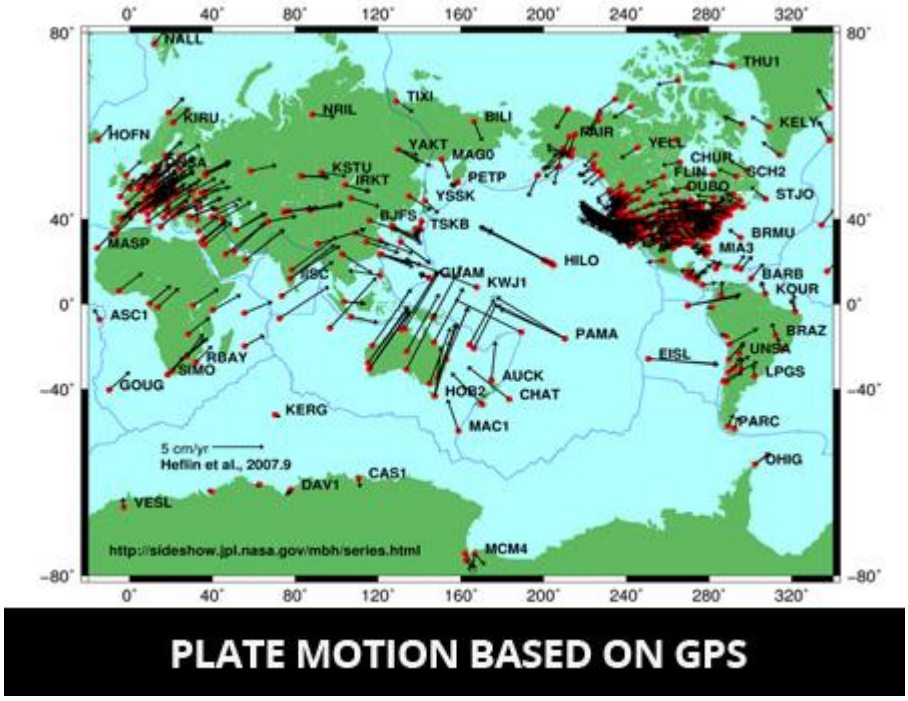

Cut out this inside semi circle
Cut out along outside

Looking for Angles in Letters

Tectonic Plate Facts

Tectonic plates are pieces of land that connect together on the Earth's outer shell. You can think of them like a giant round puzzle that cover Earth underneath the ground.

These pieces bump together and move, even though it is only a couple of centimetres a year. This movement causes all kinds of things to happen, such as volcanoes, earthquakes, and tsunamis.

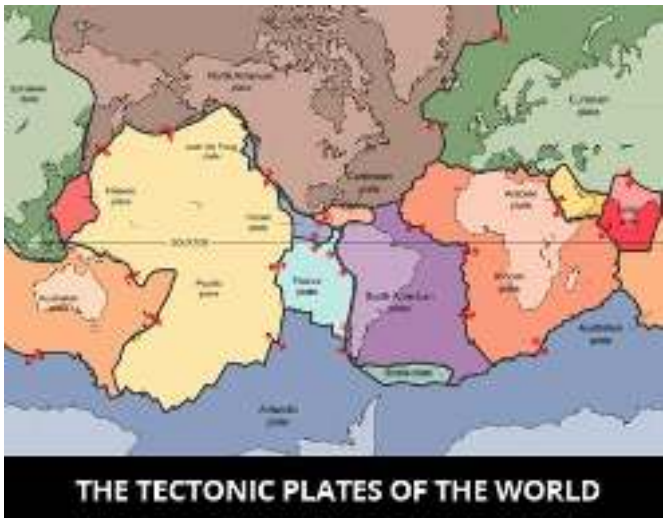


Where are Tectonic Plates Located?

Tectonic plates cover the entire Earth and are like a shell that sits underneath the top layer of the ground.

These plates sit on top of hot inner layers of the Earth, and they slowly move around on this melted layer.

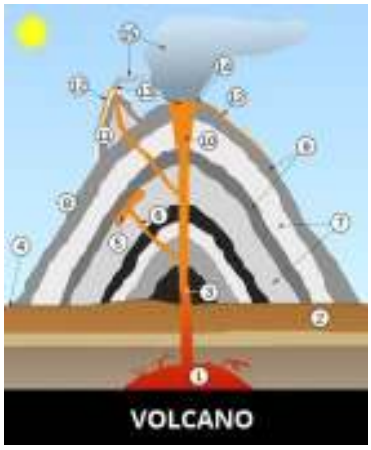
Think of it like ice cubes moving around on top of your glass of water. Even though these tectonic plates are all over, there is a certain part of the Earth where more trouble happens than others.



How are Volcanoes Formed?

Volcanoes usually happen in a certain area of the Earth, called "The Ring of Fire". The Ring of Fire is a circle of volcanoes that is located along the edge of California and swoops around to the edge of Asia.
This area of the Earth has over 75% of the world's volcanoes! That's like cutting a pizza into four big pieces, and then eating three of them.

The Ring of Fire is so full of volcanoes because of how they are formed.



Volcanoes are formed when heavier tectonic plates collide with and slide underneath lighter tectonic plates. Think of it like smashing two graham crackers together – one of them will go over the top of the other.

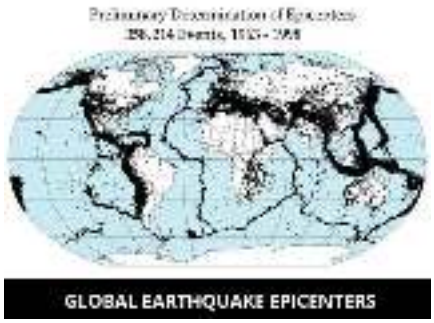
The lighter tectonic plate that goes on the top then begins to melt into magma as it pushes up. This magma will slowly harden and pile on top of itself, forming a volcano.

How does an Earthquake Happen?

Have you ever been in an earthquake? Depending on where you live, you may have never felt one before or you might feel them all of the time.

Earthquakes happen when tectonic plates push against each other, similar to the example of two graham crackers pushing together.

The difference with earthquakes, however, is that the tectonic plates are rubbing against each other and get stuck, then they suddenly slam into a new position. This quick movement is what causes the earth to shake.



GLOBAL EARTHQUAKE EPICENTERS

Over 80% of the world's most powerful earthquakes have happened along the Ring of Fire, and they have caused tons of damage and harm.

Many places that are located in the Ring of Fire have started using special buildings that can survive earthquakes, but plate tectonics are unpredictable and you never know when they will move next.

How does a Tsunami Happen?

A tsunami is a giant wave that starts in the middle of the ocean and usually makes its way to shore.

Tsunamis are also caused by the shifting of tectonic plates, and start from either an earthquake in the middle of the ocean, or a strong volcanic eruption in the ocean.

Imagine a tub of water that is gently moving back and forth, just like the ocean waves. All of a sudden, the tub gets jolted and a giant wave pushes to the edge.

This is what happens when the tectonic plates suddenly shift underneath the water. Try this the next time you are in the bath!

2011 TŌHOKU EARTHQUAKE AND TSUNAMI

The Ring of Fire, with all of its earthquakes and volcanoes because of the tectonic plates, is a popular place for tsunamis.

Around 80% of the world's tsunamis happen in the Ring of Fire, and they can cause horrible effects to the countries they hit.

These gigantic waves flood the shores and far inland, and often destroy everything in their path.

Quick Facts: Tectonic Plates

There are eight main tectonic plates and lots of smaller ones.

Tectonic plates are responsible for volcanoes, earthquakes, and tsunamis.

The Ring of Fire is a location on Earth where the big tectonic plates meet and push against each other.
When a heavy tectonic plate pushes under a light tectonic plate, the lighter one rises up and becomes a volcano.

When two tectonic plates run by each other and then suddenly snap, this causes an earthquake.

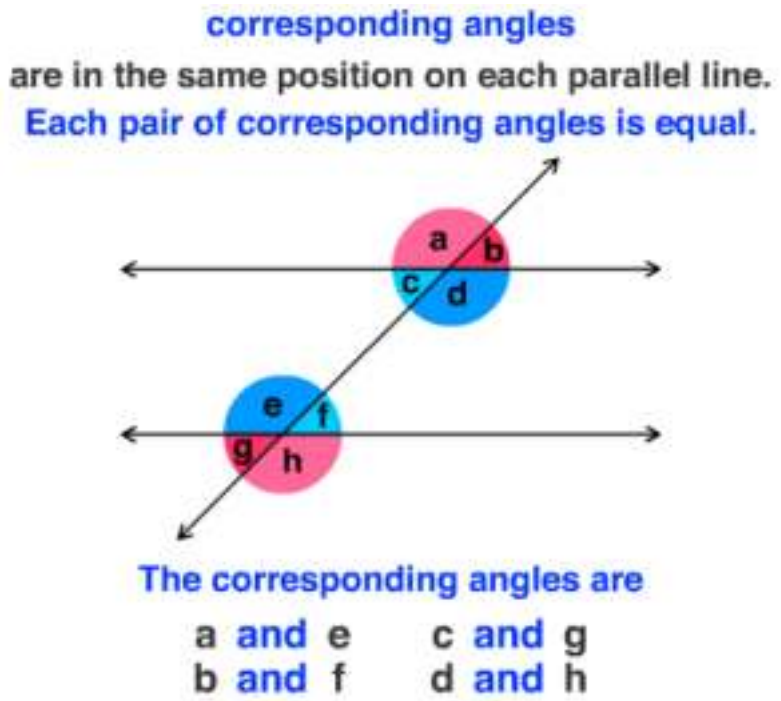
When two plates cause an earthquake or volcanic eruption in the ocean, this causes a tsunami.

Tectonic plates are found throughout the Earth and play a huge part in some of the natural disasters that happen. They are always moving and are very unpredictable.

These powerful pieces of land are responsible for earthquakes, volcanoes, and tsunamis, and are not going to stop moving and shifting anytime soon!

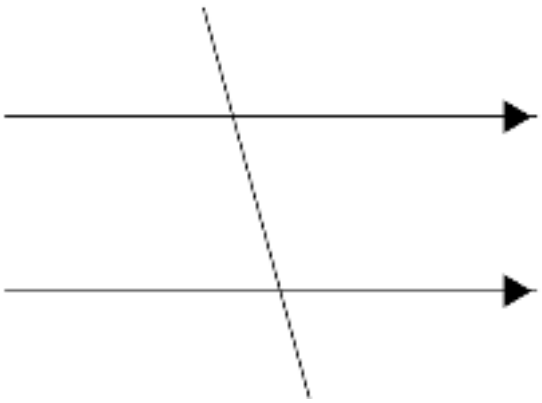
Corresponding Angles

When a straight line intersects (crosses over) two parallel lines it creates corresponding angle.



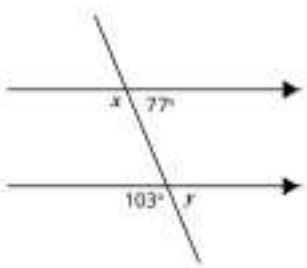
Therefore the angle at 'a' is the same value as the angle at 'e' and the angle at 'b' is the same value as the angle at 'f', and the angle at 'd' is the same value as the angle at 'h', and the angle at 'c' is the same value as the angle at 'g'.

Question 1. Use a different colour to mark each corresponding angle pair on the following diagram.

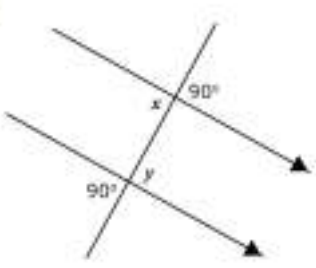


Question 2. Find the missing values of the corresponding angles marked with the letters 'x' and 'y' in the following examples.

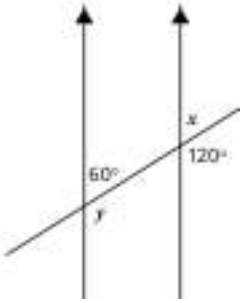
a)



b)

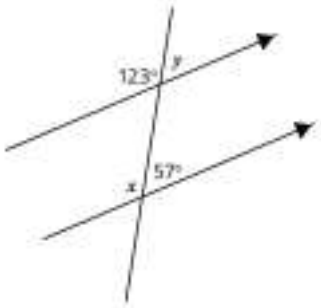


c)

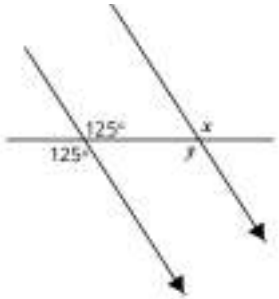


Question 2: Continued

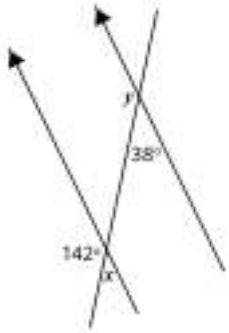
d)



e)

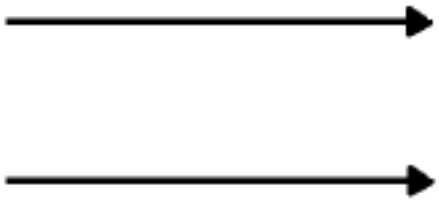


f)

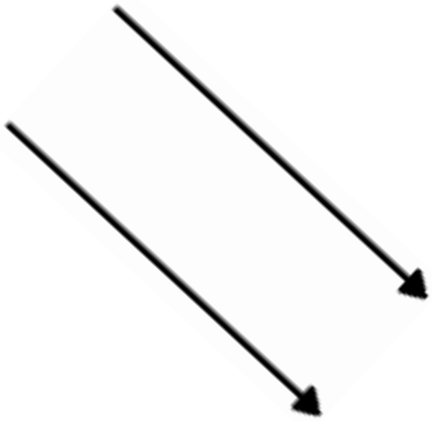


Question 3: Use a ruler or straight edge to draw your own intersecting line on the following parallel lines. Use a protractor to measure the corresponding angles you create.

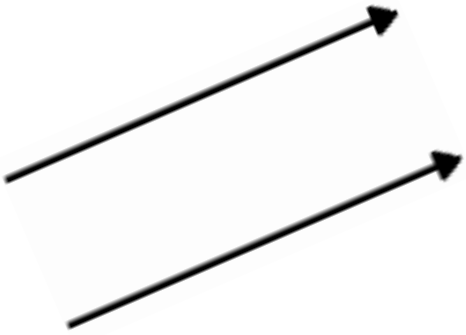
a)



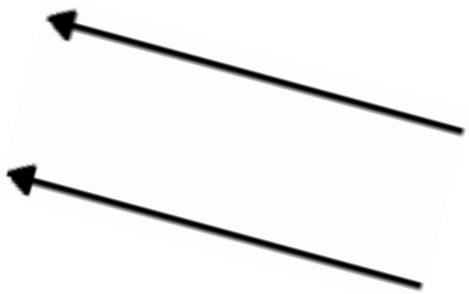
b)



c)



d)



e) Draw your own parallel lines and the intersecting line. Use a protractor to measure the corresponding angles you create.

Massive 7.2 magnitude Indonesian earthquake rocks Darwin and forces residents to flee

Phoebe Loomes, June 24, 2019 **7:05PM** news.com.au

A massive earthquake has struck off the coast of Australia, causing buildings in Darwin and the Northern Territory to shake and people to flee* into the streets.

The US Geological Survey said an earthquake reaching magnitude* 7.2 occurred in the Banda Sea off Indonesia — which sits above the Northern Territory — about 11am on Monday.

The quake, which was at a depth of 213km underground, caused tremors in Darwin for about five minutes.

Buildings shook and several hotels and businesses told staff to leave and wait outside in the central business district.

The Joint Australian Tsunami Warning Centre was quick to assure* residents the mainland was not at risk of being hit by a tsunami* because the quake "was too deep inside the earth".

A group of nurses at Royal Darwin Hospital started praying when the shaking started.

Health researcher Isabella Marovich, who was at Royal Darwin Hospital at the time, said staff, nurses and patients had been evacuated* from the hospital.

"I could see the awnings on the hospital building shaking," she said.

Robyn Williams was home at Parap when she felt the quake for almost two minutes.

"The whole house was shaking and the TV was moving a hell of a lot," she said.

"I've never felt anything like it — it was quite unnerving*."

Local resident Brian Piddick said: "I'm on one of those office chairs that swivels up and down, and I thought, 'Geez I'm not moving, it's the ground'," he said.

"What's going on with the world?"

Rosebery resident Michael O'Brien said it came at an awkward time for him.

"I'm a little bit shocked. I was sitting on the loo and the loo started to vibrate and I thought 'what the hell's going on here'," he said.

"Is there really any good time for it to come?"

NT Government worker Alfredo Borges said it had given him a shock.

"My desk and my chair was moving for a long period of time," he said.

"I'm on level four and over the past year we've had minor tremors, not like this one. The opposite building to us (swayed) and then people started evacuating."

He said he didn't hesitate to leave when he felt the tremor.

"You go through cyclones and all that but it's (an earthquake) a totally different ball game because it's uncontrollable and it happens on short quick notice, no one picks it, it's just a different feel."

Residents have also reported feeling the tremors 300km south of Darwin in Maningrida and Katherine.

Geoscience Australia senior seismologist Jonathan Bathgate said more tremors were possible in coming days.

Engineers were inspecting buildings yesterday for any serious damage.

St John's Ambulance said there were no reports of injuries.

WHAT IS AN EARTHQUAKE?

Earthquakes are the vibrations caused by rocks breaking under stress. The underground surface along which the
rock breaks and moves is called a fault plane or fault line.

When the rock breaks it releases seismic energy in waves, which causes the earth to shake.

Fortunately, smaller earthquakes occur much more frequently than large ones and most cause little or no damage.

The focus of an earthquake is the point where it originated within the Earth. The point on the Earth's surface
directly above the focus is called the earthquake epicentre.

HOW DO YOU MEASURE AN EARTHQUAKE?

Geoscience Australia monitors, analyses and reports on significant earthquakes to alert the Australian Government,
State and Territory Governments and the public about earthquakes in Australia and overseas.

Earthquakes are detected by scientific machines called seismometers or seismographs. The word seismo originates
from the Greek word *seismos*, which means to shake or move violently and was later applied to the science and
equipment associated with earthquakes.

Seismographs were used in the past to detect earthquake activity and relied on a mechanical system to record the
seismic energy in the Earth as squiggly lines onto paper.

Today, modern seismometers detect and convert any small movement in the Earth into an electrical signal for use in
computer systems.

EARTHQUAKES BIG AND SMALL

The biggest recorded earthquake was 9.6 magnitude in Chile, South America, in 1960.

The next biggest was in Alaska, US, in 1964.

The biggest recorded earthquake in Australia was magnitude 6.6 in Tennant Creek, Northern Territory in 1988.

The 1989 Newcastle earthquake was magnitude 5.6 and killed 13 people.

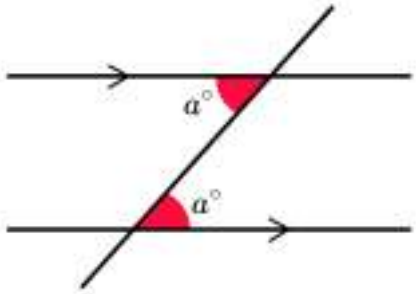
GLOSSARY

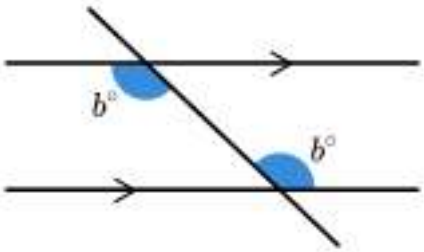
flee: escape from danger
magnitude: size or importance of something
assure: say something positive to remove doubt or fear
tsunami: gigantic wave hitting a shoreline
evacuated: removed from danger
unnerving: enough to make you nervous

Alternate Angles

When a straight line intersects (crosses over) two parallel lines it also creates alternate angles.

Alternate angles are angles that occur on opposite sides of the transversal line (the line that crosses of the parallel lines). Alternate angles have the **same size** as each other.

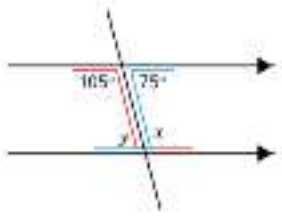




Question 1. Use a different colour to mark each alternate angle pair on the following diagram.

Question 2. Find the missing values of the alternate angles marked with the letters 'x' and 'y' in the following examples.

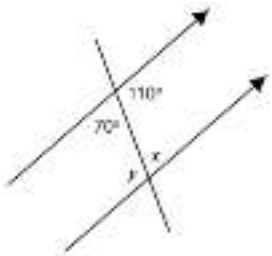
a)



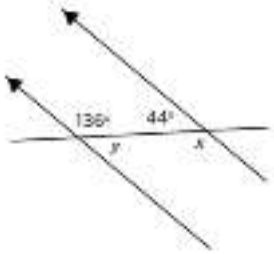
$x = 105°$

$y = 75°$

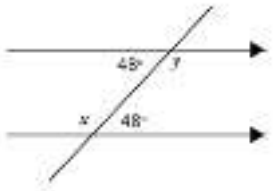
b)



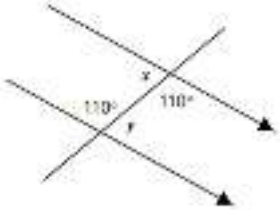
c)



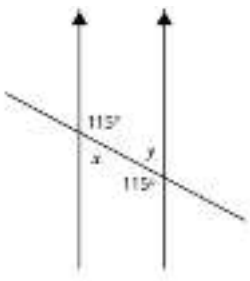
d)



e)

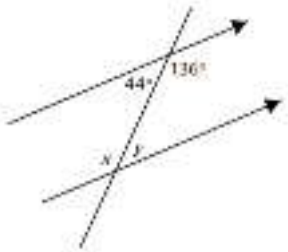


f)

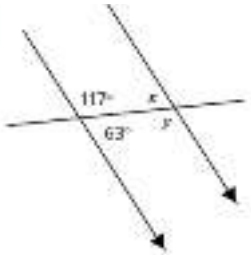


Question 2: continued.

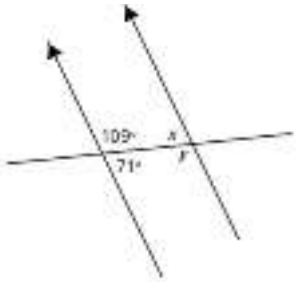
g)



h)

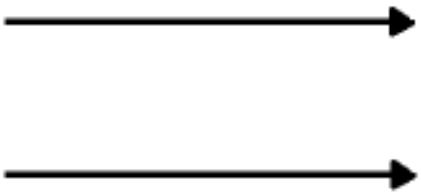


i)

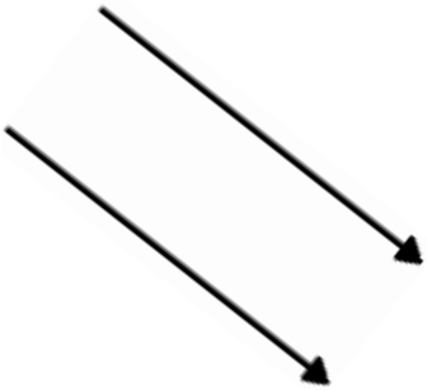


Question 3: Use a ruler or straight edge to draw your own intersecting line on the following parallel lines. Use a protractor to measure the alternate angles you create.

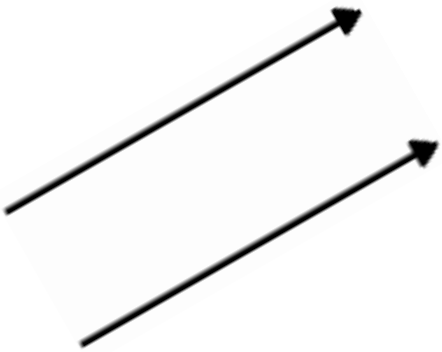
a)



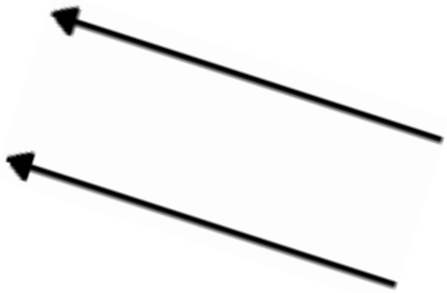
b)



c)



d)



e) Draw 3 or more sets of your own parallel lines and the intersecting lines. Use a protractor to measure the alternate angles you create.

Making Pictures with Angles

Your job today is to get artistic and create and measure angles in a fun way using a protractor.

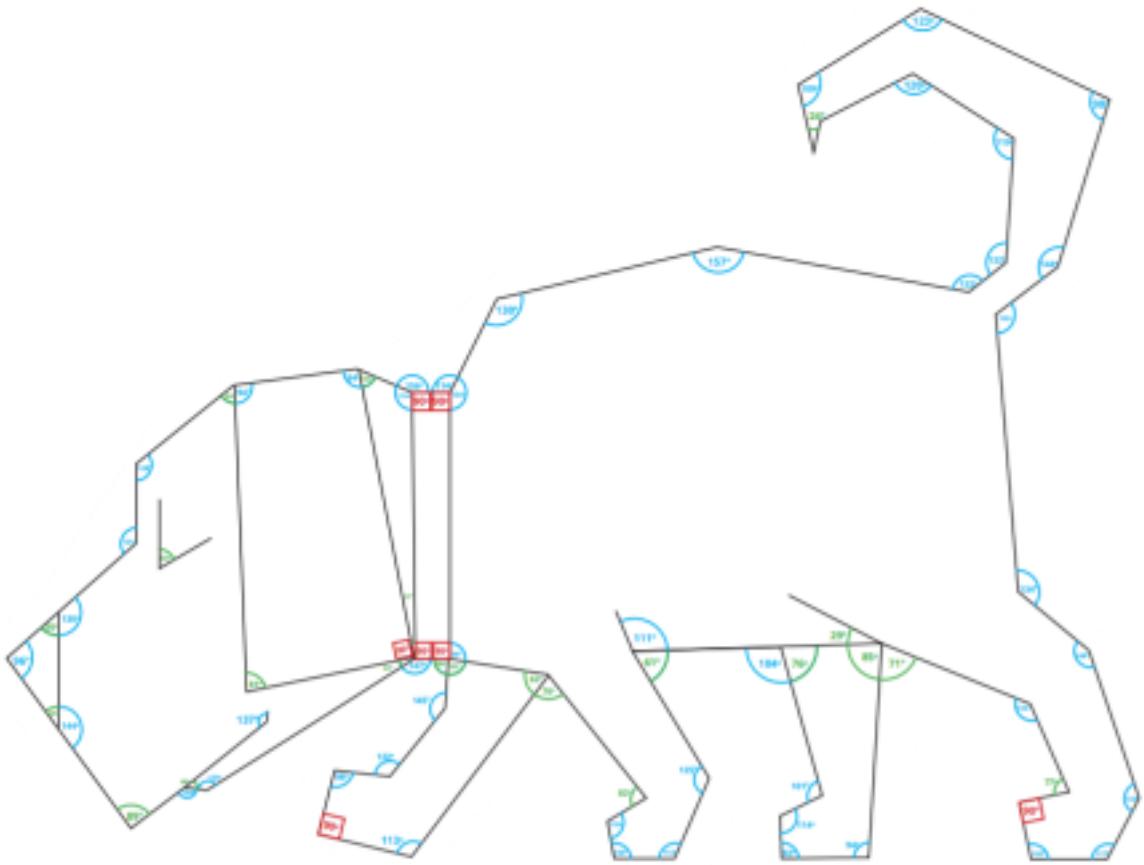
If you do not have a protractor, there is a printed version in this work booklet that can be cut out and used

TODAY'S TASK:

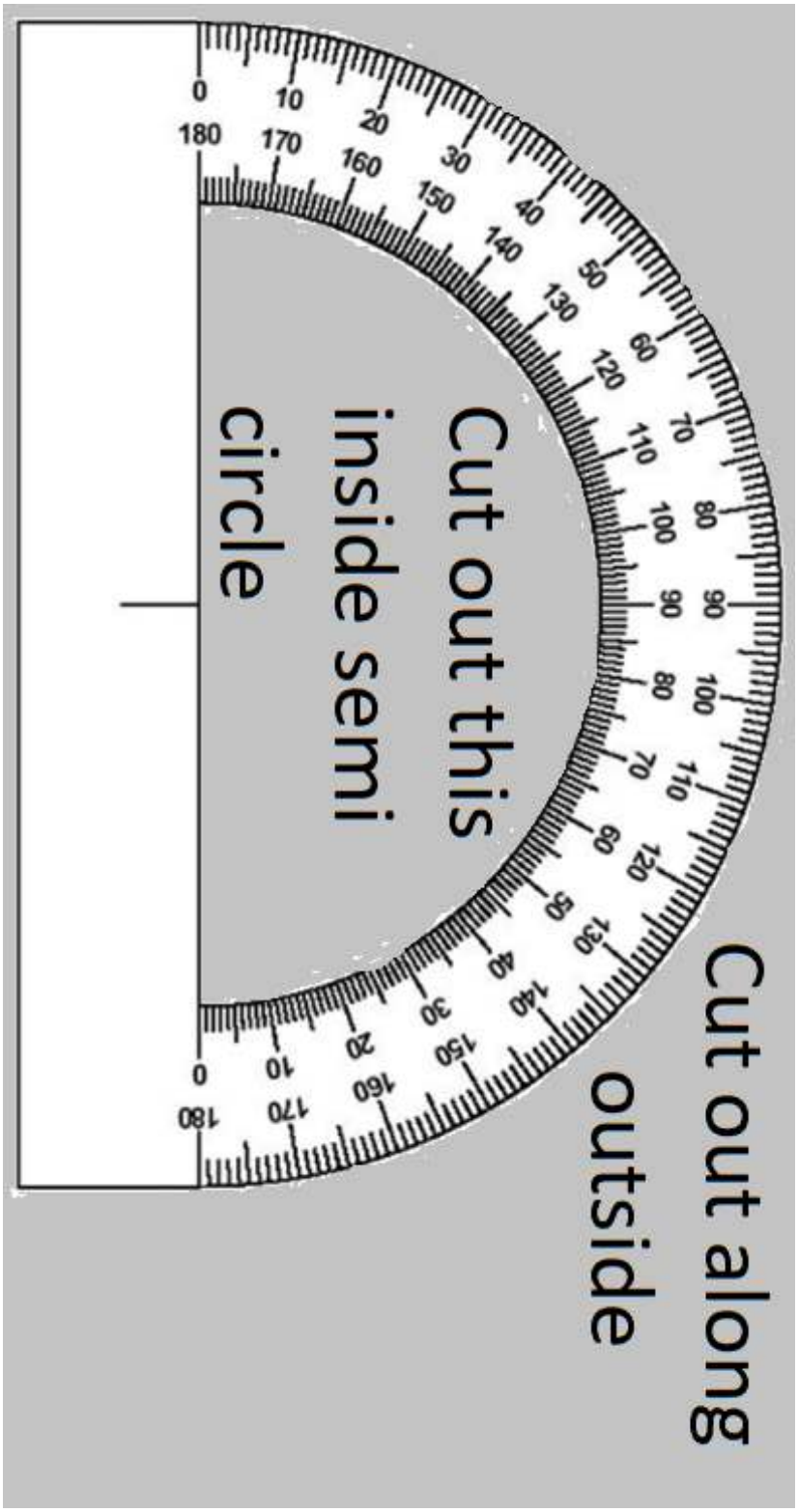
Step 1: Using a ruler or straight edge, draw a LARGE picture made up of straight lines. It should take up the A4 page provided.

Step 2: Use a protractor to measure the angles you have created within your picture.

Step 3: Colour or decorate your picture in a fun way.

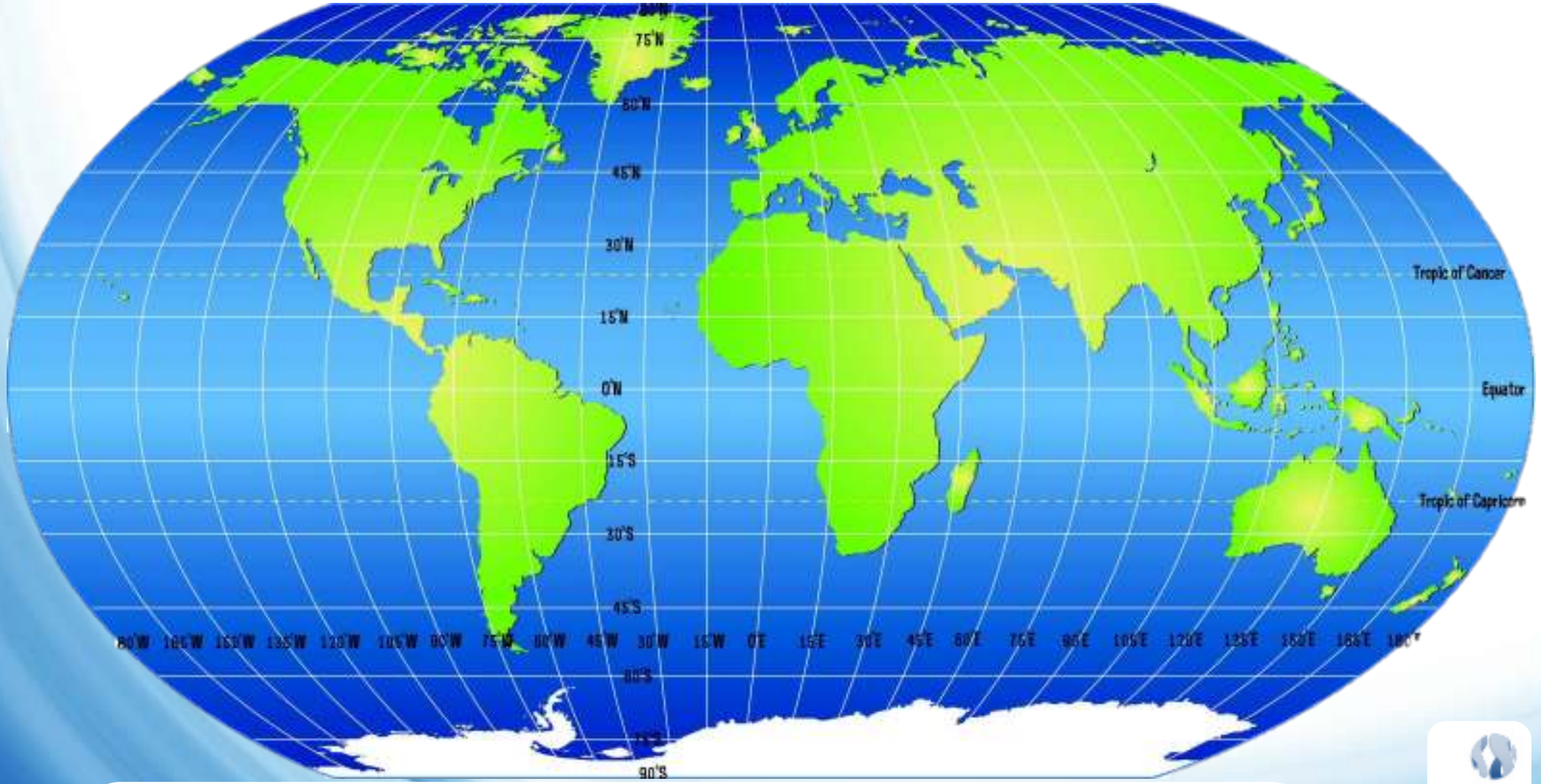


Making Pictures with Angles


Cut out this inside semi circle
Cut out along outside

Making Pictures with Angles

Locating Famous Earthquakes



Can you locate these famous earthquakes on this world map using their latitude and longitude co-ordinates?

2011 Tohoku	32°N	142°E	1985 Mexico City	18°N	102°W	1908 Messina	38°N	15°E
2011 Christchurch	43°S	172°E	1976 Tangshan	40°N	118°E	1906 San Francisco	37°N	122°W
2010 Haiti	18°N	72°W	1964 Alaska	61°N	147°W	1755 Lisbon	36°N	11°W
2010 Chile	32°S	70°W	1960 Valdivia	38°S	73°W	1556 Shaanxi	34°N	109°E
2004 Indian Ocean	3°N	95°E	1952 Kamchatka	53°N	160°E	1138 Aleppo	36°N	37°E
2001 Gujarat	23°N	70°E	1923 Great Kanto	34°N	139°E	856 Damghan	36°N	54°E

3D Geography
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