

Tangency Resource

This resource was developed as part of a Graphics CPD 2019/2020 workshop which took place during the 2019/2020 school year. All materials used during this workshop can be viewed in the Technologies section of www.jct.ie within the CPD Workshops tile.

CPD Workshop Link:

https://www.jct.ie/technologies/cpd_supports_graphics_cpd_workshops_2019_2020

This unit of learning was showcased during this workshop and focused on how a teacher activated the learning outcomes and key learning with their students and school context in mind. This sample resource may assist you in planning and developing materials suitable for your student's context. The main focus of this unit of learning was recognising, appreciating, constructing and visualizing tangency when engaging with the Graphics specification. This engagement can be found on slides 27 - 76 of the Graphics CPD 2019/2020 presentation.

What is included in this PDF?

1. Sample unit of Learning

Included is the sample unit of learning developed by the teacher for their students in their school context. Contained in the plan are the learning outcomes and key learning activated by the engaging with the worksheet.

2. Worksheets and sample activities

This PDF contains activities which were engaged with and discussed in the context that is outlined in slides 30 – 49 of the Graphics CPD 2019/2020 presentation. It is important to make note of the learning outcomes, key learning and the action verb in the unit plan which contextualise the worksheet activities.

A big thank you to the teachers involved for making this resource available to the JCT4 team.



Note: It is recommended that you view the CPD workshop materials in conjunction with using this resource to contextualise the resource and develop a better understanding of how the unit of learning was developed.

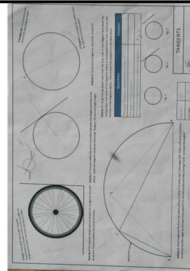


Consider the age, stage and prior learning of the students.
What learning do we want to focus on?
Explore both the strands and elements when choosing learning outcomes.

Identify the learning outcomes for your unit of learning.
Identify the key learning for students using action verbs to support your thinking.
Consider how we will assess and report evidence of learning

Develop ideas for how students could experience this learning.
How will I know they are learning?

Using your own classroom context, what methodologies and resources will support students in experiencing the learning outcomes.
Ensure assessment aligns with the learning outcomes and their action verbs



AGE AND STAGE:

Second Year Students, Term 2

PRIOR LEARNING:

Basic constructions, Orthographic projection, Rendering plane objects, ellipse construction, translations and symmetry.

FOCUS OF LEARNING:

Tangents in the real world

EXPLORE STRANDS AND ELEMENTS:

2D Graphics, Applied Graphics, Geometric Principles and Constructions, Design Thinking.

KEY LEARNING

1.1 - Visualize the movement of 2D shapes, points and lines

Action Verb: Visualise

1.1 & 1.4 - Identify tangents in everyday objects and artefacts.

Action Verbs: Visualise & Appreciate

1.12 & 1.1 - Accurately locate points of contact and construct tangents.

Action Verbs: Construct & Visualise

3.1 & 2.11 - Recognise tangency in the world around them.

Action Verbs: Recognise and appreciate

ACTION VERBS

Visualise: make something visible to the mind or imagination something that is abstract or not visible or present to the eye

Construct: develop information in a diagrammatic or logical form; not by factual recall but by analogy or by using and putting together information

Appreciate: recognise the meaning of, have a practical understanding of

Recognise: identify facts, characteristics or concepts that are critical (relevant/ appropriate) to the understanding of a situation, event, process or phenomenon

HOW COULD STUDENTS EXPERIENCE THIS LEARNING?

Sketching, Accurate drawing with drawing instruments, CAD.

Research of the local environment. Link learning to Mathematics constructions.

Design research project.

Ongoing Assessment

Teacher formative feedback throughout the unit of learning.

- Applying sketching and rendering techniques to emphasise tangent surfaces

3.1 & 2.11 - Discovery of tangents in their world and record using sketches and/or photography.

3.1 & 1.12 - Complete worksheets with tangency problems.

1.1 - Identify circle to ellipse visual connection. Application of core principle to different situations.

1.12 - Recognise angle in semicircle as 90°

1.4 - Complete design project incorporating tangency.

Summative test at the end of the unit

RESOURCES

Visualiser, Camera/Phone, Set-squares and CAD enabled computers available, Sketching equipment & tracing paper. 3D teaching and learning models of tangents.

METHODOLOGIES

Teacher Demonstration of core knowledge, ghost walk and primary research, sketching, concept attainment and research project.

HOW WILL STUDENTS EXPERIENCE THE LEARNING OUTCOMES?

3.1 & 2.11 - Concept attainment exercise to introduce tangents.

1.12 & 1.1 - Construct tangent and normal to ground concept. Definitions of point, line and tangent discussed. Use of tracing paper.

2.11 & 3.1 - Identify and highlight tangency in a ghost walk by taking pictures and/or examples online similar to objects seen on walk.

1.12 - Examination of the why the construction works using colour. Constructing solutions to various tangent problems.

1.1 - Translation of tangent and normal on tracing paper to highlight that it is same principle.

1.4 & 3.1 - Complete a research project to identify and highlight tangency in the world around them.

REFLECTION

Links to Maths may be established and ensure this unit aligns with Mathematics constructions and Theorems

Concept Attainment:

As part of this unit of learning students started with a concept attainment activity. This activity uses a series of slides which have two images, one image which contains the geometric concept that is the focus of the learning and another image which does not contain the geometric concept. The instructions and slides used are shown below via screengrabs of the PowerPoint slides 30-37 from the 2019/2020 Graphics CPD PowerPoint presentation.

The Focus of the Learning?

- What is the concept?
- Focus on the **Yes** examples.
- The **No** examples will clarify your thinking.
- Write down your thoughts after each example.

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Yes

No

1.



Yes

No

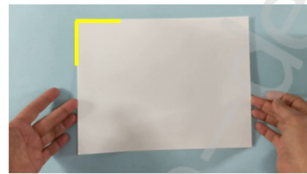
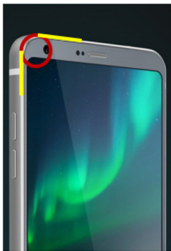
2.



Yes

No

3.



Yes

No

4.

Testers



Test your perceived concept against the next two images. Each image is either showing the concept or is not. This should clarify your thinking.

Yes

or

No

5.



Yes

or

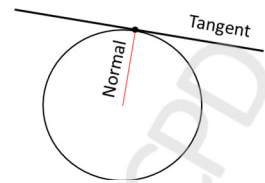
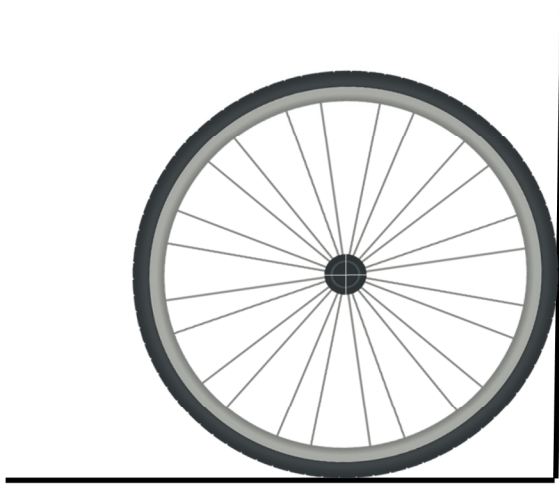
No

6.



Activity 1:

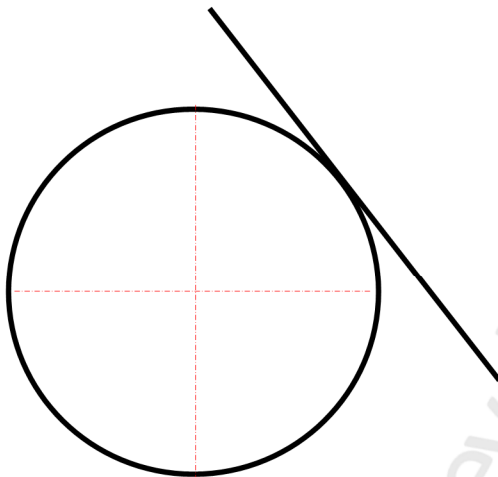
A bicycle wheel rests on the ground and up against a wall as shown. Find accurately the points of contact. Identify the tangent and the normal in each case.



A Point "that which has no part". A point in geometry is a location. It has no size, no width, no length and no depth. Two lines intersect at a point.

Activity 2:

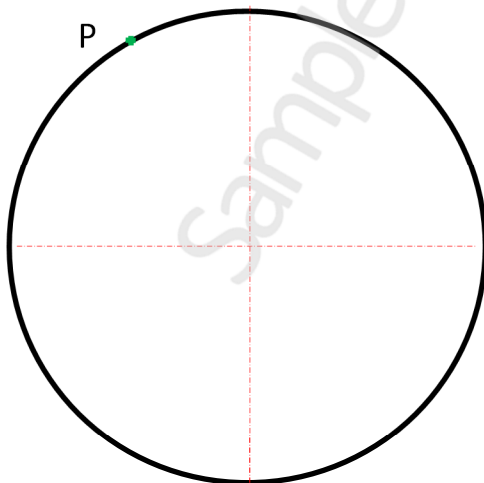
Trace the tangent and normal from Activity 1 onto tracing paper. Using the tracing paper, find accurately the point of contact between the tangent and circle below. Identify and label the right angle (90°).



A Straight line "is a line which lies evenly with the points on itself"

Activity 3:

Construct a tangent to the circle below at point P. Use the tracing paper to help you with your solution.

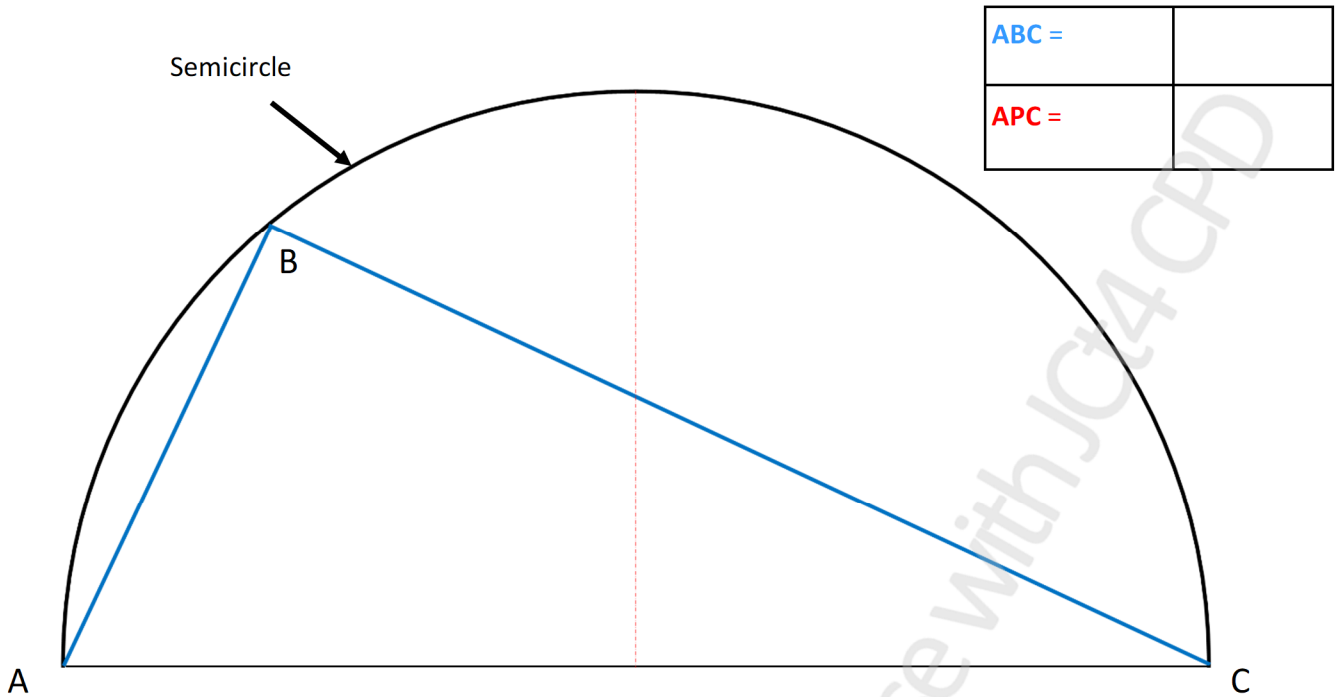


A Tangent is a straight line which touches a given curve at one point only and doesn't pass through the curve.

Activity 4:

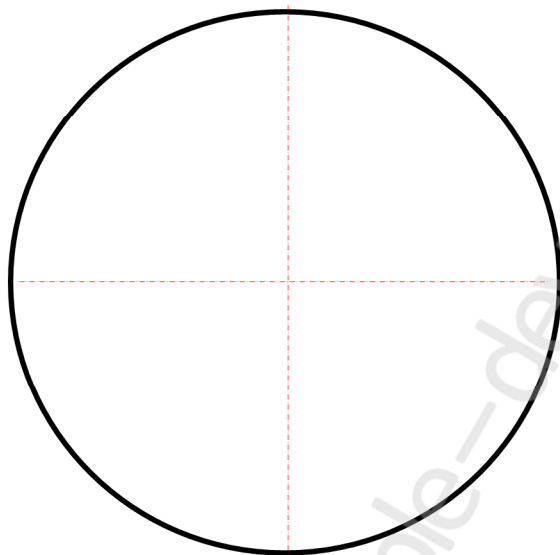
What size is the angle ABC? Check it with your protractor. Construct another angle by joining A to any point P on the circumference of the semicircle and then joining back to C. How do the angles compare?

Use the tracing paper from activity 1 to verify your answer.



Activity 5:

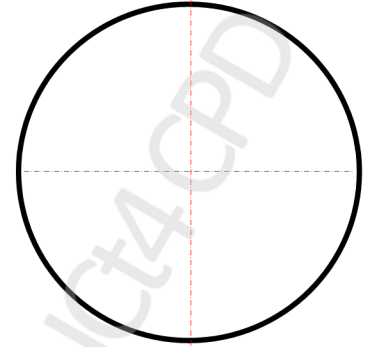
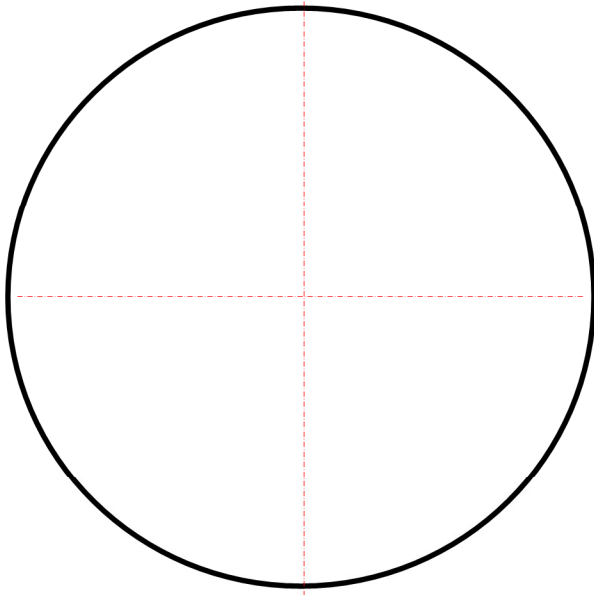
Construct accurately a tangent to the circle from point P. Find the point of contact for the tangent. The diagram below will help you with your solution.



+ P

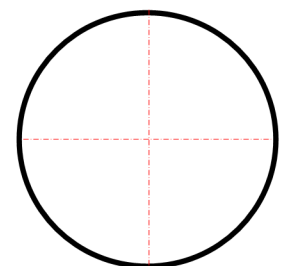
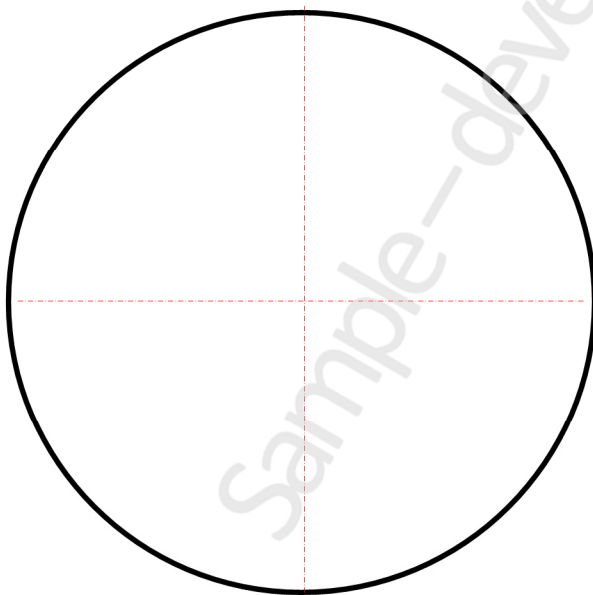
Activity 6:

Construct accurately an internal tangent to the circles shown below. Find the points of contact.



Activity 7:

Construct accurately an external tangent to the circles shown below. Find in each case the point of contact.



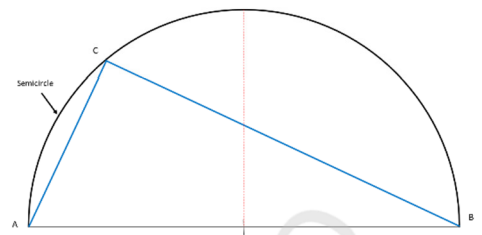
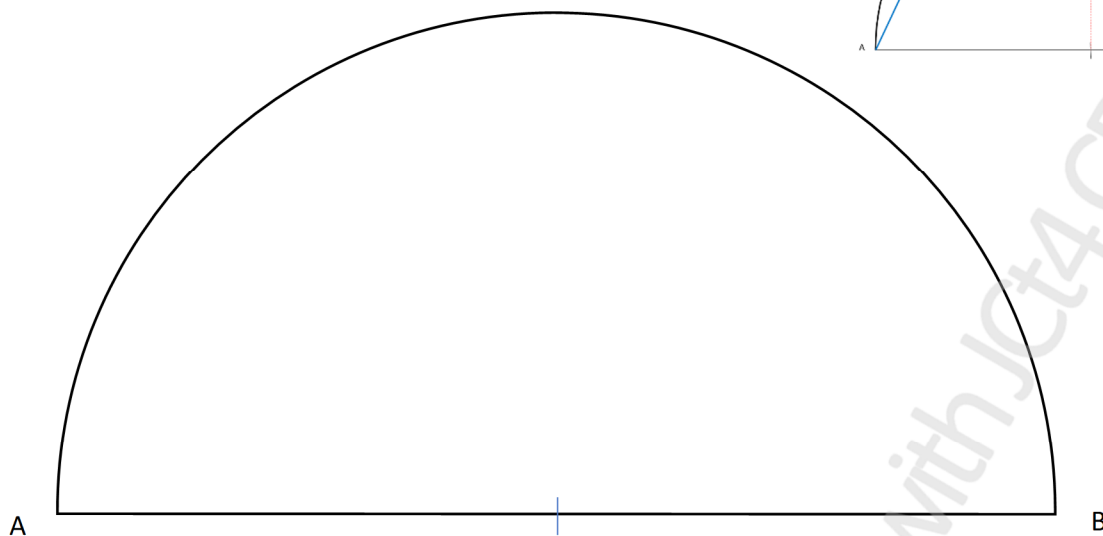
Activity 8: Following a journey to school a student collected a collage of graphics and pictures from the trip.

- Analyse the pictures and graphics shown above and identify the tangents seen in the graphics and illustrate the geometry using notes and sketches.

Tangents in the world around me



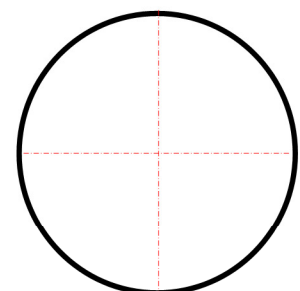
Sample developed for use with Jct4 CPD



1. Join A and B to any point C on the circumference of the semicircle.
2. Join C to the centre of the semicircle.
3. Identify two isosceles triangles.
4. What is the sum of all the internal angles in these two isosceles triangles?
5. Use matching colours to identify angles of equal size.
6. Use two different colours to identify the two inside angles at the centre of the circle.
7. Use the Pie chart graphic below to represent the size of each angle.
8. Can you conclude what the size of angle ACB is?

Notes:

Sample-developed for use with Jct4 CPD



Use the four colours to graphically represent the size of the angles in the circle above.

Spatial Reasoning Moment

Construct a tangent to the ellipse at point P, without finding the focal points.

