Centres of a Triangle Worksheet

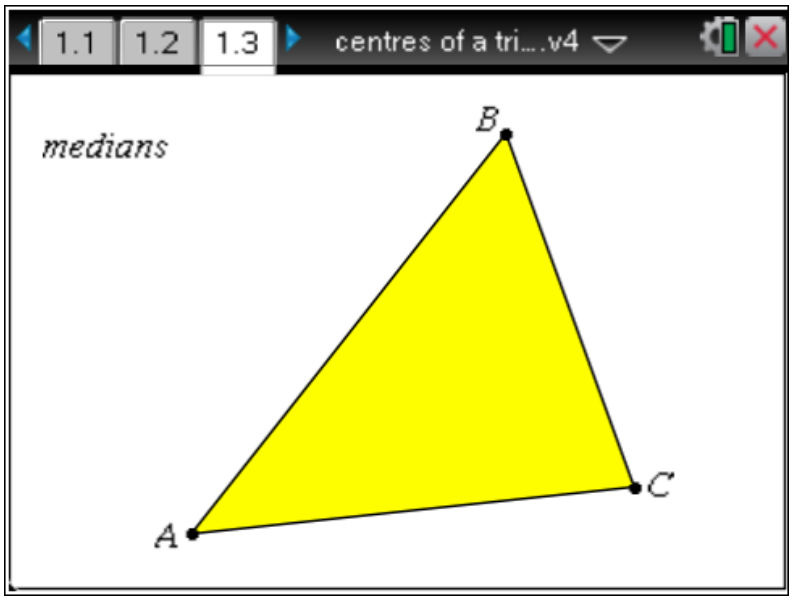
1). Construct the 3 **medians** of the triangle ABC.

Find the **midpoint** of each line.

(menu) [A] Constructions
(5) Midpoint
select side AB
select side BC
select side AC (esc)

Draw the **medians** from A, B and C.
(menu) (7) Points & Lines
(4) Line
select A and midpoint of BC
select B and midpoint of AC
select C and midpoint of AB
(esc)

Draw these lines on the diagram.



Find the **point of intersection**.
(menu) (7) Points & Lines (3) Intersection Point(s) select line 1 select line 2 (esc)
The point of intersection of the **medians** is called the **CENTROID**.
Label this point ***cen*** select intersection point (ctrl)(menu) (2) Label ***cen*** (enter)
Grab A, B and C. Do the medians **always** intersect?
Does the ***centroid*** ever move **outside** the triangle?
Move to page 2.1.

2). Construct the 3 **altitudes** of the triangle ABC.

Draw the **altitude** through A.

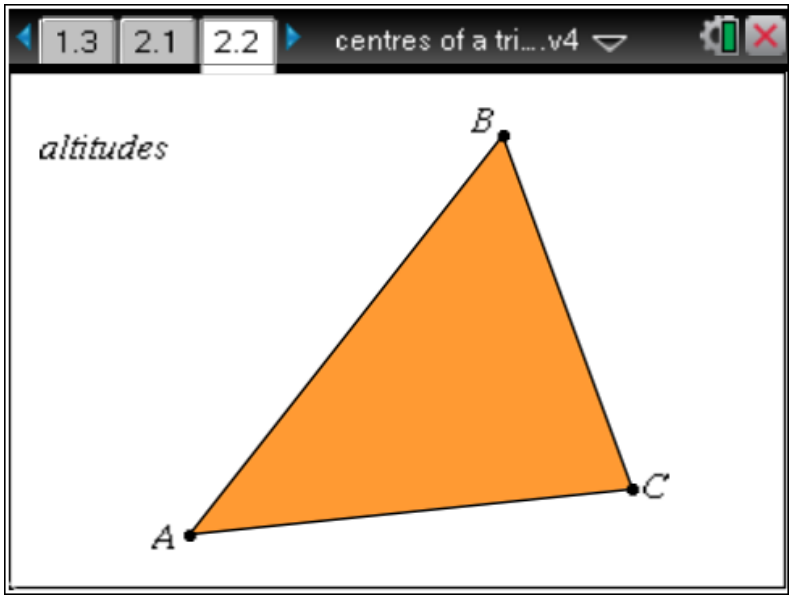
(menu) [A] Constructions
(1) Perpendicular
select point A and side BC.

Similarly draw the **altitudes** through B and C (esc)

Grab the end of the altitudes and extend them to fill the page.

Draw these lines on the diagram.

Find the **point of intersection**.
(menu) (7) Points & Lines
(3) Intersection Point(s)
select line 1 select line 2 (esc)



The point of intersection of the **altitudes** is called the **ORTHOCENTRE**.
Label this point ***orth*** select intersection point (ctrl)(menu) (2) Label ***orth*** (enter)
Grab A,B and C. Do the altitudes **always** intersect?
Does the ***orthocentre*** ever move **outside** the triangle? Move to page 3.1.

3). Construct the 3 **perpendicular bisectors** of the triangle ABC.

Draw the **perpendicular bisector** of AB.

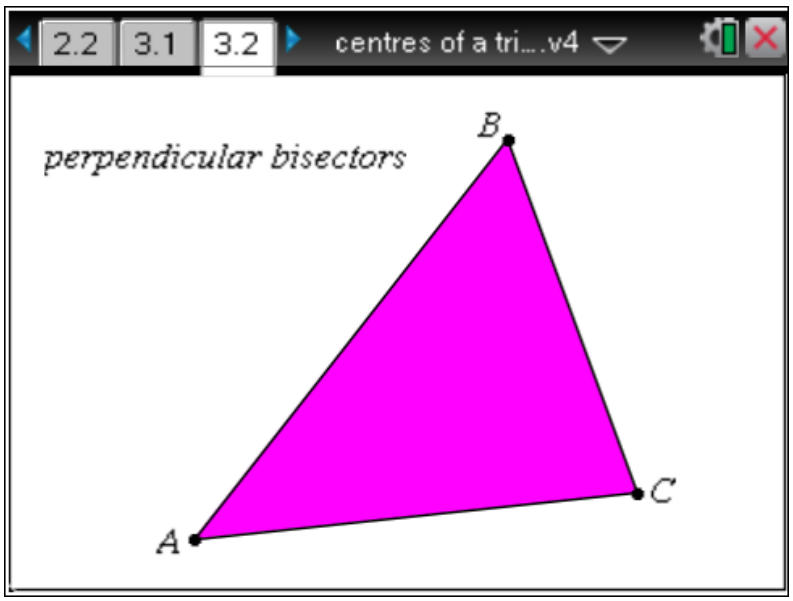
(menu) [A] Constructions
(3) Perpendicular Bisector
select side AB.

Similarly draw the **perpendicular bisectors** of BC and AC (esc)

Grab the end of the lines and extend them to fill the page.

Draw these lines on the diagram.

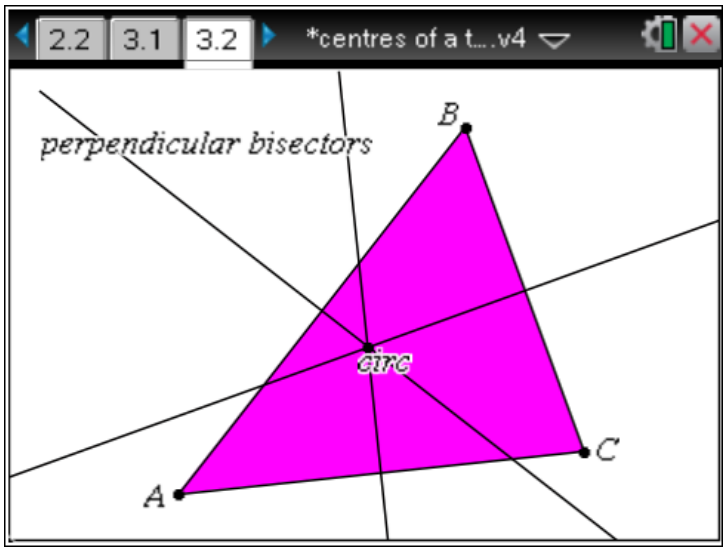
Find the **point of intersection**.



The point of intersection of the **PERPENDICULAR BISECTORS** is called the **CIRCUMCENTRE**. Label this point ***circ***.

Grab A,B and C. Do the perpendicular bisectors **always** intersect?
Does the ***circumcentre*** ever move **outside** the triangle?

Undo grabbing and moving A,B and C by entering (ctrl) (esc) until the screen returns to the one shown on the right.



Draw a **circle** with the **CIRCUMCENTRE** as the centre, dragging it so that it passes through one of the vertices A, B or C.
(menu) (9) Shapes (1) Circle select point ***circ*** as the centre / drag the circle so that one of the vertices of the triangle lies on the circumference / enter / escape. What do you notice?

Hide the perpendicular bisectors (menu) (1) Actions (3) Hide/Show select the lines using
(Your screen should show triangle ABC and a circle with centre ***circ***) (esc)

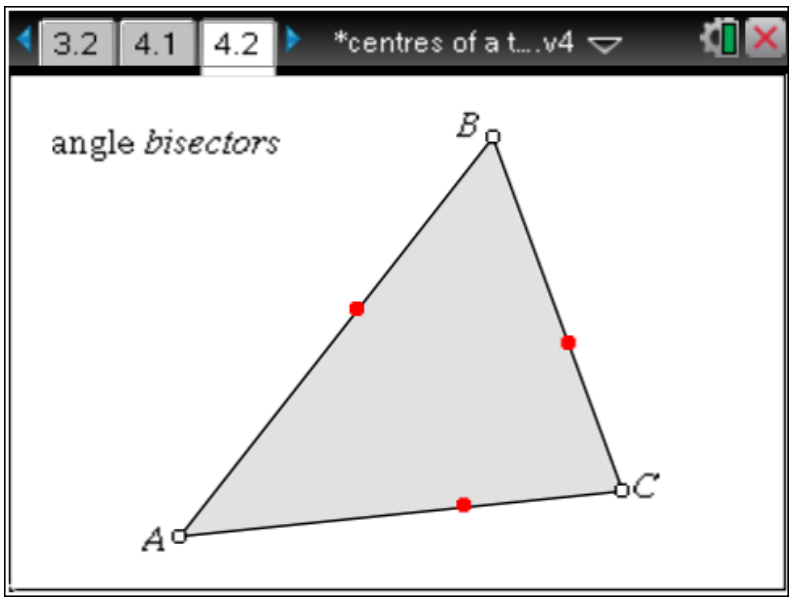
Grab A,B and C. Note what happens.

This circle is called the **CIRCUMCIRCLE.** Move to page 4.1.

4). Construct the 3 **angle bisectors** of the triangle ABC.

Draw the **angle bisector** of angle A.

(menu) [A] Constructions
(4) Angle Bisector
select point on side AB
select point A
select point on side AC



Similarly draw the **angle bisector** of angle B and angle C (esc)

Grab the end of the lines and extend them to fill the page.
Draw these lines on the diagram.

Find the **point of intersection**.

The point of intersection of the **ANGLE BISECTORS** is called the **INCENTRE**.
Label this point ***inc***.

Grab A,B and C. Do the angle bisectors **always** intersect?
Does the ***incentre*** ever move **outside** the triangle?
Undo grabbing and moving A, B and C by entering (ctrl) (esc) until the screen returns to show the original triangle ABC and the ***incentre inc***.

Draw the **largest circle** that lies inside the triangle with this point as the centre.
(menu) (9) Shapes (1) Circle select point ***inc*** as the centre / drag the circle so that one of the red dots lies on the circumference / enter / escape. What do you notice?

Hide the angle bisectors (menu) (1) Actions (3) Hide/Show select the lines using
(Your screen should show triangle ABC and a circle with centre *inc*). (esc)

Grab A, B and C. Note what happens.

This circle is called the **INCIRCLE.**

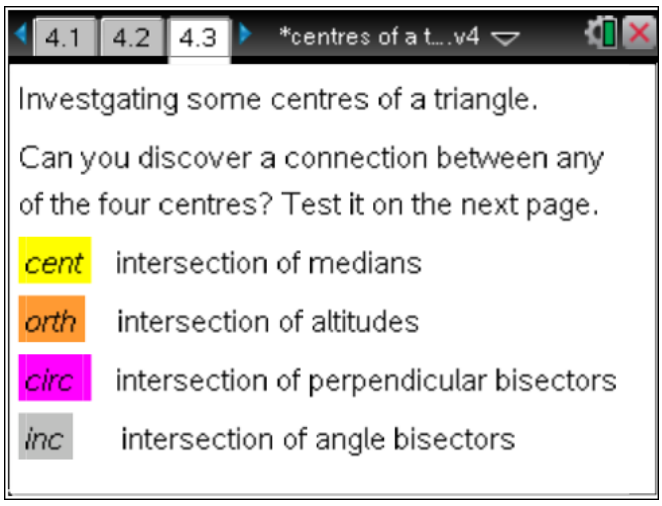
Move to page 4.3 and see if you can discover a connection between some of these centres of a triangle.

Test your theory on page 4.4.

Grab A, B and C to see if this connection still holds.

Which centres always remain **inside** the triangle?

When will the 4 centres become the **same point**?
Move to page 5.1.



5). The **NINE-POINT CENTRE** of the triangle ABC.

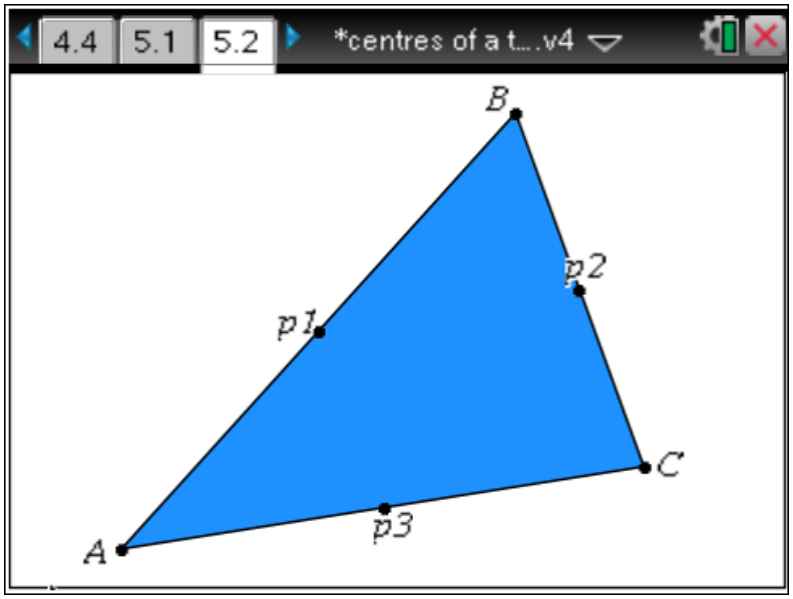
On page 5.2 start by finding the midpoints of the three sides of the triangle ABC and label them ***p1, p2*** and ***p3***.

(menu) [A] Constructions
(5) Midpoint select side AB, side BC and side AC (esc)

select midpoint of AB
(ctrl)(menu) (2) Label ***p1*** (enter)

Similarly label ***p2*** and ***p3***.

On the diagram show how you can find the **centre of the circle** passing through these three points.
(hint : start by drawing segments ***p1p2*** and ***p1p3***).

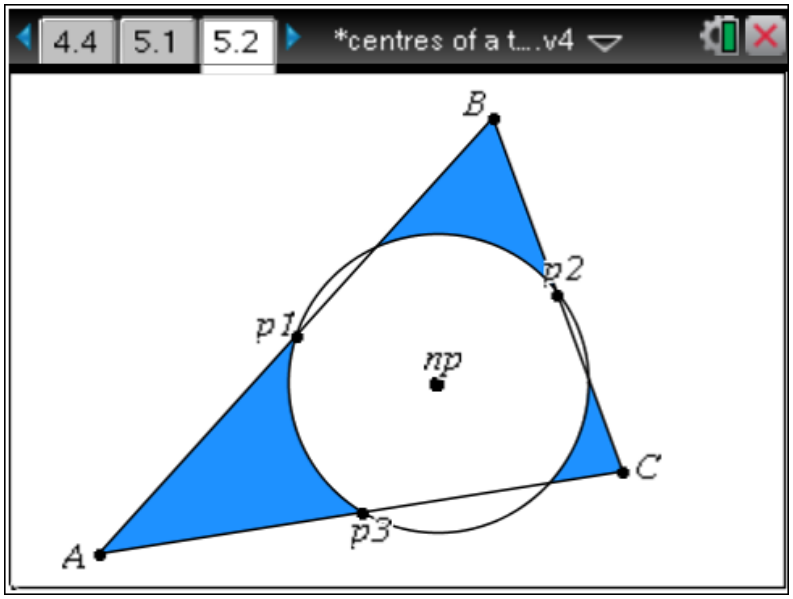


Find the **centre** on the handheld and label the point ***np*** **(the 9-point centre)**.

Hide the construction lines leaving only the triangle and points ***p1,p2,p3*** and ***np*** on the screen.
(menu) (1) Actions (3) Hide/Show select the lines and the segments using (esc)

Draw the circle centre ***np*** passing through ***p1, p2*** and ***p3.***
(menu) (9) Shapes (1) Circle

Fill this circle with white.
open hand over the circle (ctrl)(menu) [B] Colour (2) Fill Colour select white



Your screen should now look like the one shown above.

The next 3 points ***p4, p5*** and ***p6*** are the points of intersection of the altitudes of triangle ABC with the sides of the triangle.

Draw the altitude from A (menu) [A] Constructions (1) Perpendicular select point A and side BC.
Similarly draw the altitudes through B and C (esc)

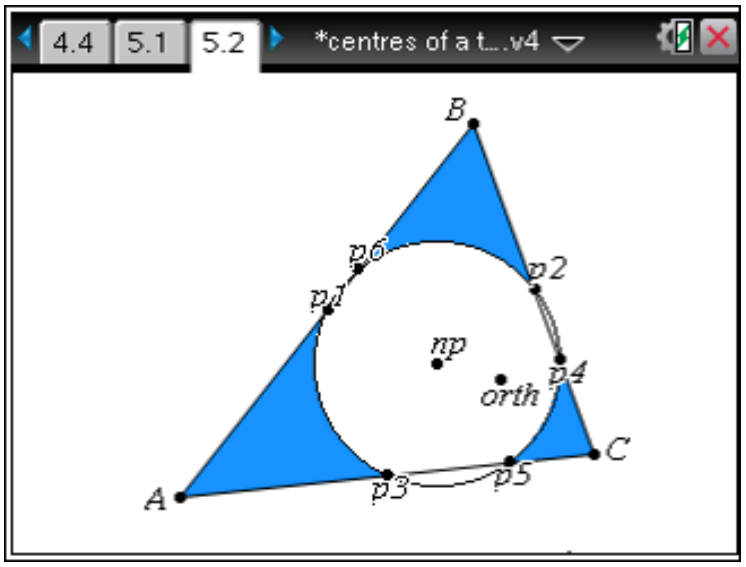
Find the point of intersection of the altitude from A with side BC. Label it ***p4***.
Similarly find the intersection of the altitude from B with side AC (label ***p5***) and the intersection of the altitude from C with side AB (label ***p6***).
What do you notice about these 3 points?

The orthocentre is required to find the last 3 points.
Find the point of intersection of the altitude from A and the altitude from B. Label it ***orth.***

Hide the altitudes leaving only the triangle and points **p1** to **p6** , ***np*** and ***orth*** on the screen.

(menu) (1) Actions (3) Hide/Show select the lines using (esc)

Your screen should now look like the one shown on the right.



The last 3 points ***p7, p8*** and ***p9*** are the midpoints of the lines joining the vertices A, B and C to the orthocentre.

Draw a segment from the intersection point ***orth*** to the vertex A.
(menu) (7) Points and Lines (5) Segment select ***orth*** and vertex A

Similarly draw segments from ***orth*** to vertex B and ***orth*** to vertex C (esc)

Find the midpoint of the segments. Label them ***p7, p8*** and ***p9***.

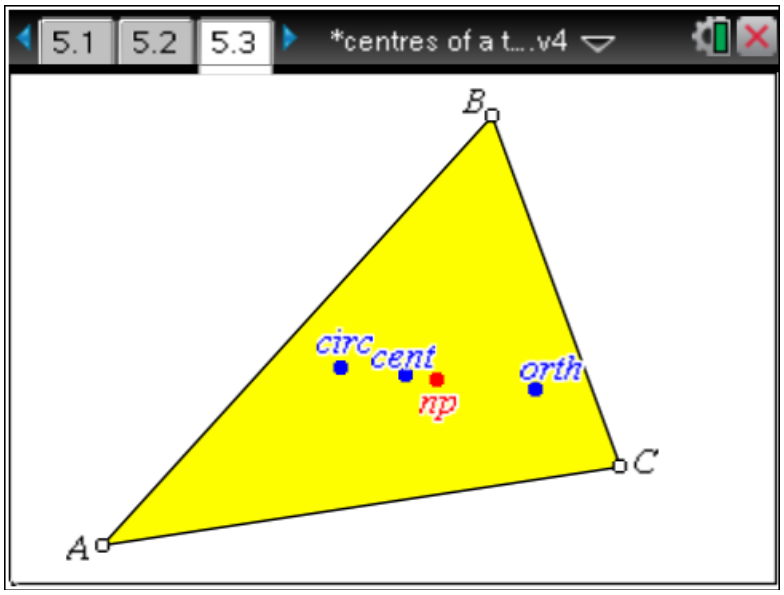
Draw the segments on the diagram above and label points ***p7, p8*** and ***p9***.
Can you see why ***np*** is called the **9-point centre**?

Move to page 5.3 where the **Nine-point Centre** has been added to the 3 centres which were connected.

Is the 9-point centre connected in the same way?
Test your theory.

Grab A, B and C to see if the connection still holds.

Draw the connection on the diagram.



Move to page 5.4 and complete the following:

The four centres lie on a _____

This _____ is called the _____

Extension Task.

The **CENTROID** divides each **MEDIAN** in the ratio _____