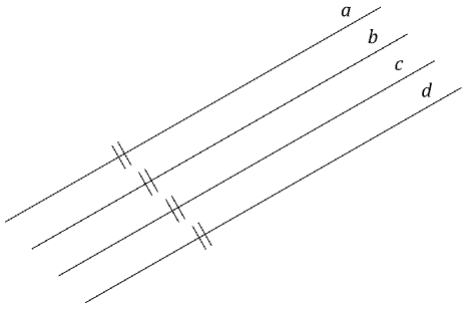
# Basic geometrical definitions and constructions

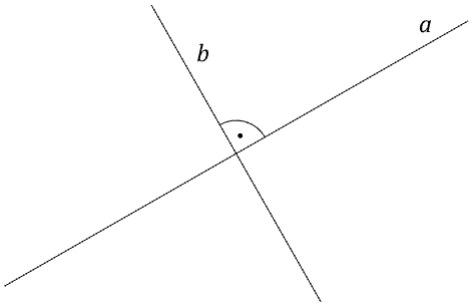
## 1. Parallel straight lines

Two or more lines that lie in the same plane and never intersect each other. Parallel lines are equidistant from each other and have the same slope.
Symbol: $a \parallel b$



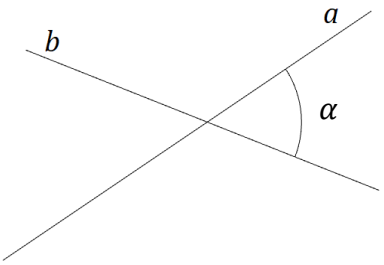

## 2. Perpendicular straight lines

Two distinct lines which intersect at each other at 90°.
Symbol: $a \perp b$



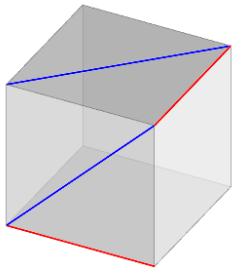

## 3. Intersecting lines

Two distinct lines which intersect each other at given angle $\alpha \neq 90°$.
Symbol: $a \times b$



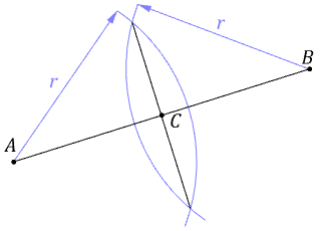

## 4. Skew straight lines

Two distinct lines in three-dimensional space not lying in the same plane.



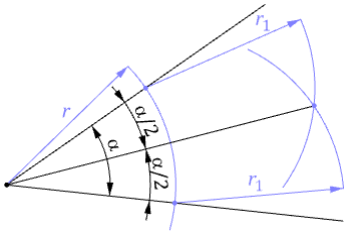
## 5. Centre of straight line segment

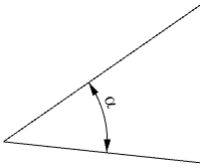
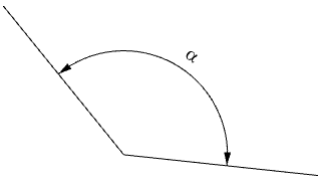
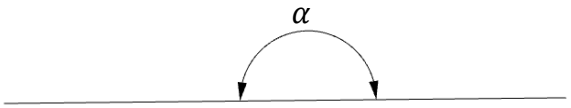
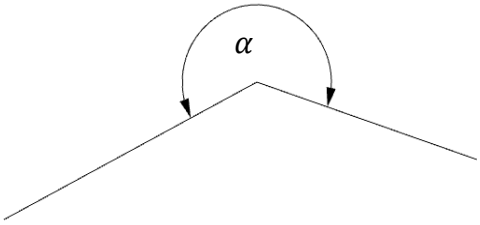
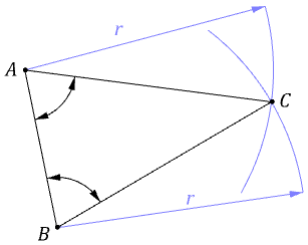
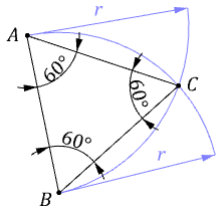
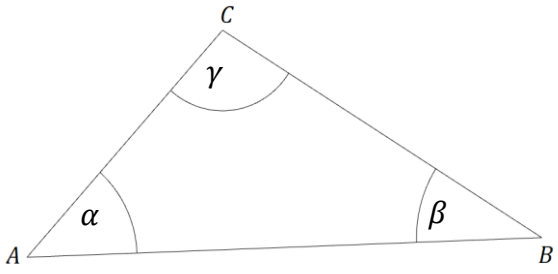
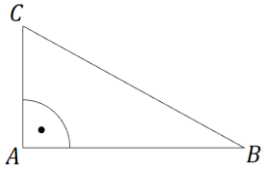
The midpoint of a straight line segment that is at the same distance or halfway between the two endpoints.
$C = \frac{\|AB\|}{2}, \| AC \| = \| BC \|$

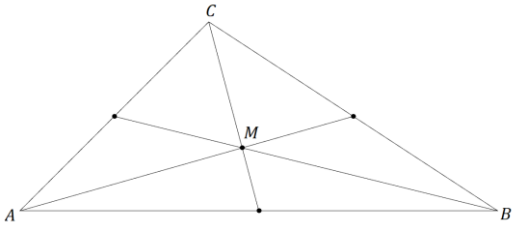
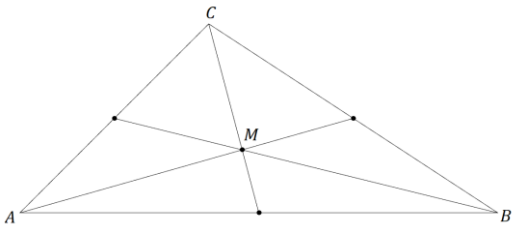
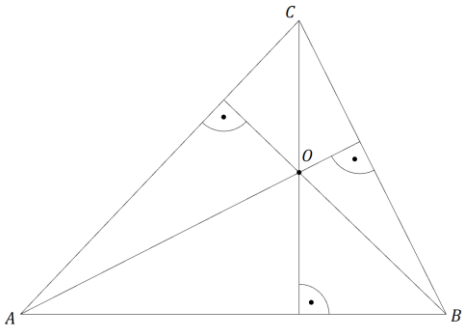
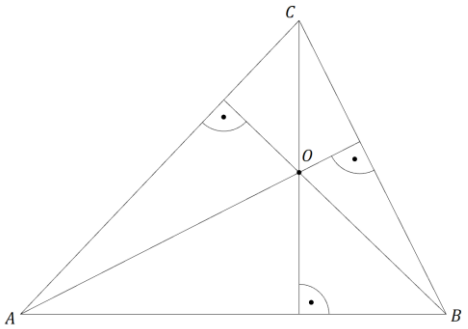
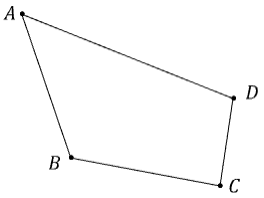
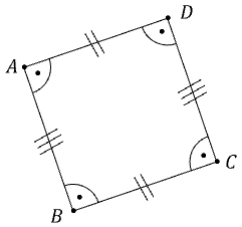


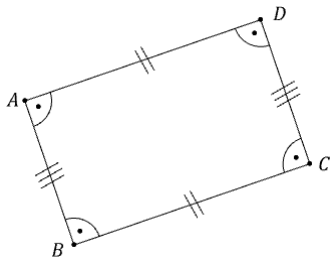
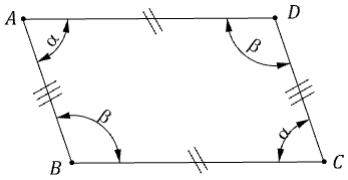
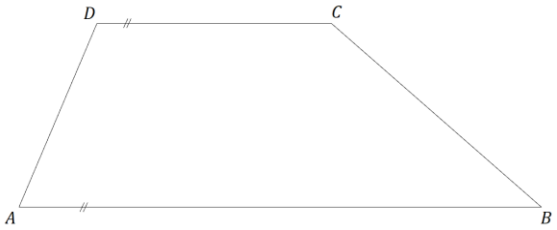
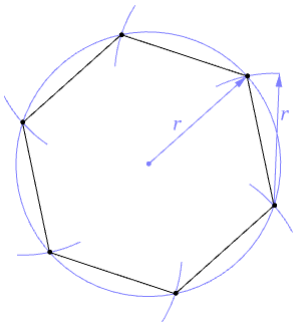
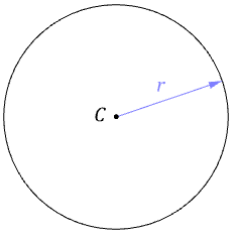
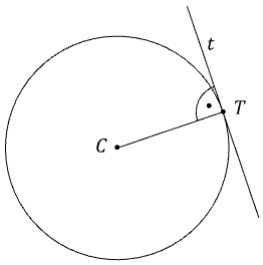
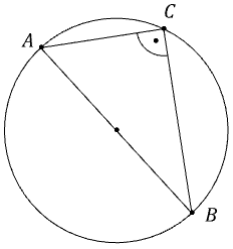

## 6. Angle bisector

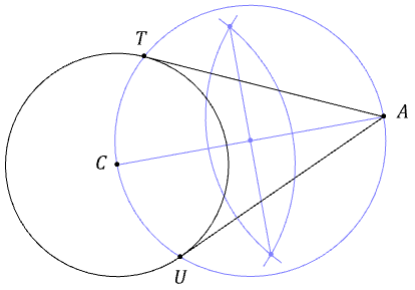
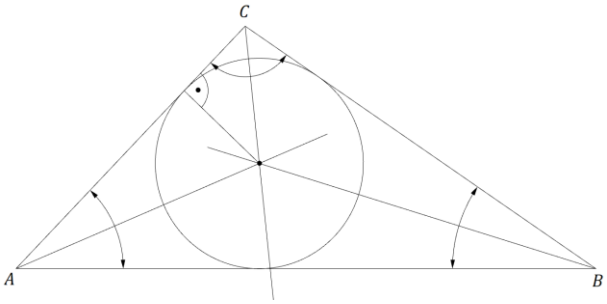
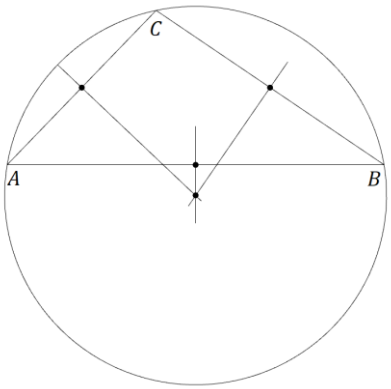
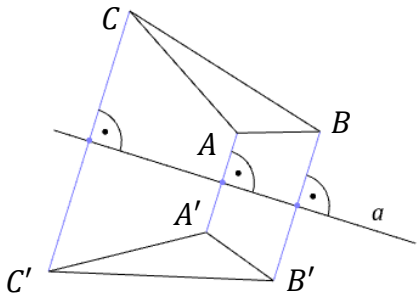
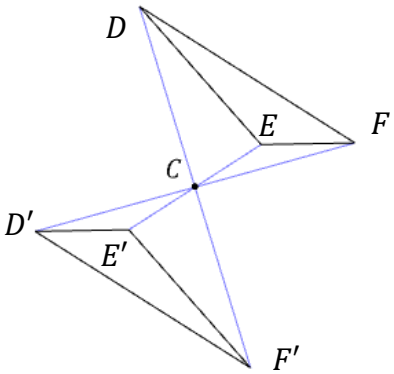
Straight line that divides a given angle into two angles of equal measures.
$r$ can be equal to $r_1$



| | |
|---|---|
| **7. Acute angle**<br>An angle less than 90° |  |
| **8. Obtuse angle**<br>An angle greater than 90° and less than 180° |  |
| **9. Straight angle**<br>An angle that has magnitude exactly 180° |  |
| **10. Reflex angle**<br>An angle that has magnitude more than 180° and not more than 360° |  |
| **11. Isosceles triangle**<br>A triangle that has two sides of equal length. The angles opposite to the equal sides are equal.<br>$r = \| AC \| = \| BC \|$ |  |
| **12. Equilateral triangle**<br>A triangle with all sides equal and all angles equal to 60°.<br>$r = \| AC \| = \| BC \| = \| AB \|$ |  |
| **13. Scalene triangle**<br>A triangle that has all three sides of different length. |  |
| **14. Right-angled triangle**<br>A triangle with one angle equal to 90°. The longest side opposite to 90° angle is called hypotenuse and the other are legs. |  |

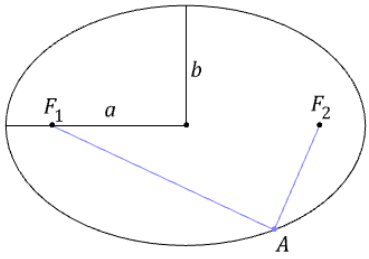
| | |
|---|---|
| **15. Triangle median**<br>A straight line drawn from the vertex to the mid-point of the opposite side is median of a triangle. All medians meet at centroid. |  |
| **16. Triangle centroid**<br>A straight line drawn from the vertex to the mid-point of the opposite side is median of a triangle. All medians meet at centroid. |  |
| **17. Triangle altitude (height)**<br>A straight line drawn from the vertex perpendicular to the opposite side is altitude of a triangle. All altitudes meet at orthocentre. |  |
| **18. Triangle orthocentre**<br>A straight line drawn from the vertex perpendicular to the opposite side is altitude of a triangle. All altitudes meet at orthocentre. |  |
| **19. Quadrilateral**<br>A four-sided polygon |  |
| **20. Square**<br>Regular quadrilateral, i.e. all sides are equal and all angles are equal to 90°. |  |

| | |
|---|---|
| **21. Rectangle**<br>A quadrilateral with all angles equal to 90° and opposite sides equal and parallel. |  |
| **22. Parallelogram**<br>A quadrilateral with opposite sides equal and parallel. |  |
| **23. Trapezium**<br>A four-sided figure with two sides parallel. |  |
| **24. Regular hexagon**<br>A six-sided polygon with all sides equal and all angles equal to 120°. |  |
| **25. Circle**<br>A set of points in a plane whose distance $r$ (radius) from a fixed point $S$ (centre) is constant. |  |
| **26. Tangent line to the circle at the point lying on the circle**<br>A line that touches the circle at exactly one point. |  |
| **27. Thales's theorem (circle)**<br>If $AB$ is the diameter of the circle and $C$ is a distinct point on the circle, the angle $\angle ABC$ is a right angle. |  |

| | |
|---|---|
| **28. Tangent line to the circle from the point lying outside the circle**<br>A line that touches the circle at exactly one point. |  |
| **29. Circle inscribed into a triangle**<br>Circle, that touches all sides of a triangle. Its centre is called incentre and it is a point of intersection of the angle bisectors. |  |
| **30. Circle circumscribed around a triangle (circumcircle)**<br>Circle, that passes through the vertices of a triangle. Its centre is called circumcentre and it is a point of intersection of the perpendicular bisector. |  |
| **31. Axial symmetry**<br>A symmetry around an axis. The axially symmetric figure can be obtained by rotating of the original figure around the axis (by 180°).<br>$\| Aa \| = \| A'a \|, \| Ba \| = \| B'a \|,$<br>$\| Ca \| = \| C'a \|$ |  |
| **32. Central symmetry**<br>A symmetry around a point. The centrally symmetric figure can be obtained by rotating of the original figure around the point by 180°.<br>$\| DC \| = \| D'C \|, \| EC \| = \| E'C \|,$<br>$\| FC \| = \| F'C \|$ |  |

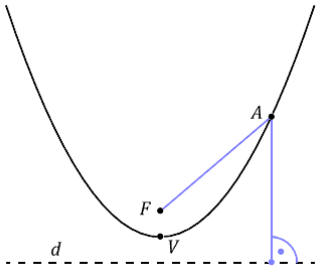
## 33. Ellipse

A set of points in a plane the sum of whose distances from two fixed points $F_1$ and $F_2$ (the foci) is equal to the length of major axis of the ellipse $\| AF_1 \| + \| AF_2 \| = 2a$



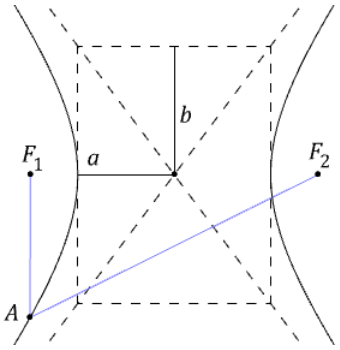

## 34. Parabola

A set of points in a plane that are equidistant from a fixed point $F$ (focus) and a fixed straight line $d$ (directrix), $\| AF \| = \| Ad \|$, $\| VF \| = \| Vd \|$.
$\| Fd \|$ is called parameter of the parabola.



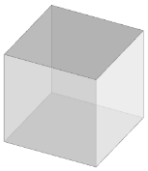

## 35. Hyperbola

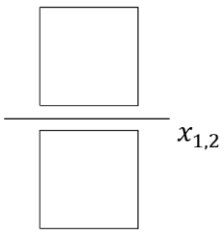
A set of points in a plane the absolute value of difference of whose distances from two fixed points $F_1$ and $F_2$ (the foci) is equal to the length of major axis of the hyperbola
$| \| AF_2 \| - \| AF_1 \| | = 2a$




## 36. Cube

3D view
Top/front view (in Monge projection) is an orthogonal parallel projection of a cube onto a horizontal/frontal plane of projection.

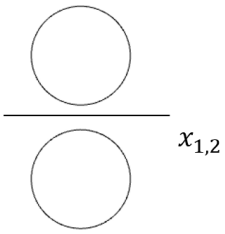





## 37. Sphere

3D view
Top/front view (in Monge projection) is an orthogonal parallel projection of a sphere onto a horizontal/frontal plane of projection.

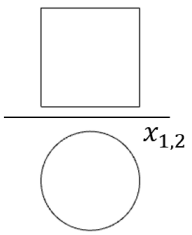


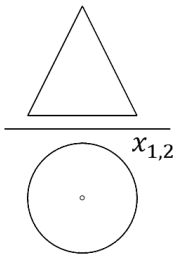
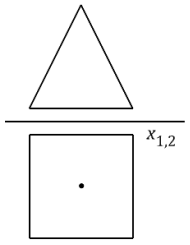
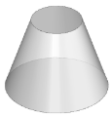
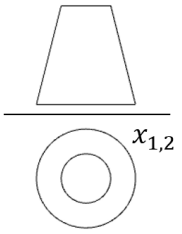
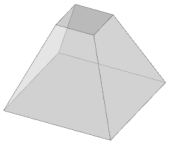
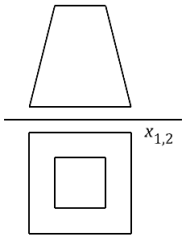
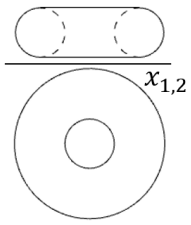
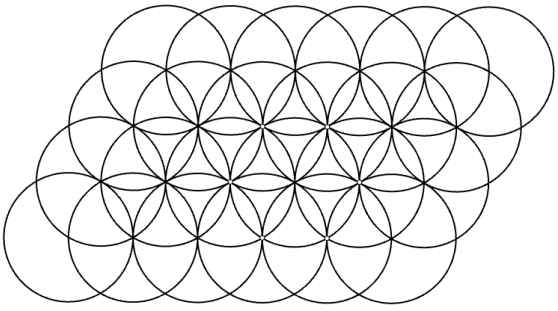



## 38. Cylinder

3D view
Top/front view (in Monge projection) is an orthogonal parallel projection of a cylinder onto a horizontal/frontal plane of projection.





| | | |
|---|---|---|
| 39. Cone<br>3D view<br>Top/front view (in Monge projection) is an orthogonal parallel projection of a cone onto a horizontal/frontal plane of projection. |  |  |
| 40. Pyramid<br>3D view<br>Top/front view (in Monge projection) is an orthogonal parallel projection of a pyramid onto a horizontal/frontal plane of projection. |  |  |
| 41. Truncated cone<br>3D view<br>Top/front view (in Monge projection) is an orthogonal parallel projection of a truncated cone onto a horizontal/frontal plane of projection. |  |  |
| 42. Truncated pyramid<br>3D view<br>Top/front view (in Monge projection) is an orthogonal parallel projection of a truncated pyramid onto a horizontal/frontal plane of projection. |  |  |
| 43. Torus<br>3D view<br>Top/front view (in Monge projection) is an orthogonal parallel projection of a torus onto a horizontal/frontal plane of projection. |  |  |
| 44. Compass control training |  | |