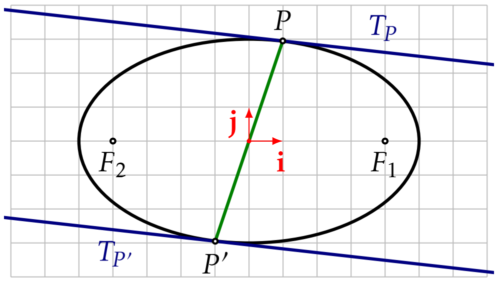
1. Determine the foci (focal points) of the Ellipse $9x^2 + 25y^2 - 225 = 0$

2. Determine the intersection of the line $\ell : x + 2y - 7 = 0$ and the ellipse $\mathcal{E} : x^2 + 3y^2 - 25 = 0$.

3. Determine the position of the line $\ell : 2x + y - 10 = 0$ relative to the ellipse $\mathcal{E} : \frac{x^2}{9} + \frac{y^2}{4} - 1 = 0$.

4. Determine an equation of a line which is orthogonal to $\ell : 2x - 2y - 13 = 0$ and tangent to the ellipse $\mathcal{E} : x^2 + 4y^2 - 20 = 0$.

5. A *diameter* of an ellipse is the line segment determined by the intersection points of the ellipse with a line passing through the center of the ellipse. Show that the tangent lines to an ellipse at the endpoints of a diameter are parallel.



6. Using the gradient, prove the reflective properties of an ellipse.

7. Determine the common tangents to the ellipses

$$\frac{x^2}{45} + \frac{y^2}{9} = 1 \quad \text{and} \quad \frac{x^2}{9} + \frac{y^2}{18} = 1.$$

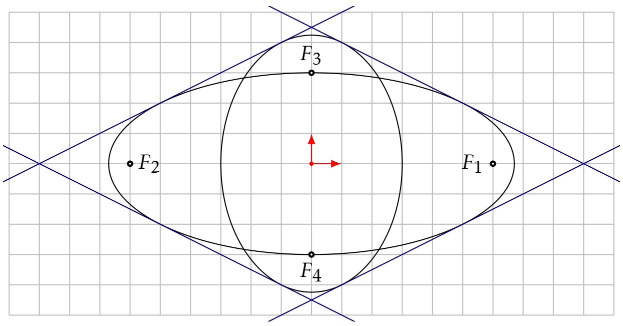


Figure 0.1: Gemeinsame Tangenten.

8. Consider the ellipse $\mathcal{E} : \frac{x^2}{4} + y^2 - 1$ with focal points F_1 and F_2. Determine the points M, situated on the ellipse for which

1. the angle $\measuredangle F_1 M F_2$ is right;
2. the angle $\measuredangle F_1 M F_2$ is θ;
3. the angle $\measuredangle F_1 M F_2$ is maximal.

9. Consider the ellipse $\mathcal{E} : x^2 + 4y^2 = 25$. Find the chords on the ellipse which have the point $A(7/2, 7/4)$ as midpoint.

10. Consider the ellipse $\mathcal{E} : \frac{x^2}{25} + \frac{y^2}{9} = 1$. Determine the geometric locus of the midpoints of the chords on the ellipse which are parallel to the line $\ell : x + 2y = 1$.

11. Find the equation of the circle:

1. passing through $A(3,1)$ and $B(-1,3)$ and having the center on the line $\ell : 3x - y - 2 = 0$;
2. passing through $A(1,1)$, $B(1,-1)$ and $C(2,0)$;
3. tangent to both $\ell_1 : 2x+y-5 = 0$ and $\ell_2 : 2x+y+15 = 0$ if the tangency point with ℓ_1 is $M(3,-1)$.