

ANALYTICAL GEOMETRY; SUMMARY & EXERCISES*

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Free High School Science Texts Project

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1 Analytical Geometry; Summary and Exercises

- Figures can be represented on the Cartesian plane
- The formula for finding the distance between two points is:

$$\text{Distance} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \quad (1)$$

- The formula for finding the gradient of a line is:

$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1} \quad (2)$$

- The formula for finding the midpoint between two points is:

$$S \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \quad (3)$$

- If two lines are parallel then they will have the same gradient, i.e. $m_{AB} = m_{CD}$. If two lines are perpendicular then we have: $-\frac{1}{m_{AB}} = m_{CD}$

2 End of Chapter exercises

1. Represent the following figures on the Cartesian plane:
 - a. Triangle DEF with D(1;2), E(3;2) and F(2;4)
 - b. Quadrilateral GHIJ with G(2;-1), H(0;2), I(-2;-2) and J(1;-3)
 - c. Quadrilateral MNOP with M(1;1), N(-1;3), O(-2;3) and P(-4;1)
 - d. Quadrilateral WXYZ with W(1;-2), X(-1;-3), Y(2;-4) and Z(3;-2)

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¹<http://www.fhsst.org/lgv>

2. In the diagram given the vertices of a quadrilateral are $F(2;0)$, $G(1;5)$, $H(3;7)$ and $I(7;2)$.

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Figure 1

- a. What are the lengths of the opposite sides of FGHI?
- b. Are the opposite sides of FGHI parallel?
- c. Do the diagonals of FGHI bisect each other?
- d. Can you state what type of quadrilateral FGHI is? Give reasons for your answer.

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3. A quadrilateral ABCD with vertices $A(3;2)$, $B(1;7)$, $C(4;5)$ and $D(1;3)$ is given.
- a. Draw the quadrilateral.
 - b. Find the lengths of the sides of the quadrilateral.

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4. ABCD is a quadrilateral with vertices $A(0;3)$, $B(4;3)$, $C(5;-1)$ and $D(-1;-1)$.
- a. Show that:
 - i. $AD = BC$
 - ii. $AB \parallel DC$
 - b. What name would you give to ABCD?
 - c. Show that the diagonals AC and BD do not bisect each other.

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5. P, Q, R and S are the points $(-2;0)$, $(2;3)$, $(5;3)$, $(-3;-3)$ respectively.
- a. Show that:
 - i. $SR = 2PQ$
 - ii. $SR \perp PQ$
 - b. Calculate:
 - i. PS
 - ii. QR
 - c. What kind of a quadrilateral is PQRS? Give reasons for your answers.

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6. EFGH is a parallelogram with vertices $E(-1;2)$, $F(-2;-1)$ and $G(2;0)$. Find the co-ordinates of H by using the fact that the diagonals of a parallelogram bisect each other.

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7. PQRS is a quadrilateral with points $P(0; 3)$; $Q(2;5)$; $R(3;2)$ and $S(3;-2)$ in the Cartesian plane.
- a. Find the length of QR.
 - b. Find the gradient of PS.
 - c. Find the midpoint of PR.

²<http://www.fhsst.org/liZ>

³<http://www.fhsst.org/liB>

⁴<http://www.fhsst.org/lac>

⁵<http://www.fhsst.org/lax>

⁶<http://www.fhsst.org/laa>

d. Is PQRS a parallelogram? Give reasons for your answer.

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8. $A(2;3)$ and $B(2;6)$ are points in the Cartesian plane. $C(a;b)$ is the midpoint of AB. Find the values of a and b.

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9. Consider: Triangle ABC with vertices A (1; 3) B (4; 1) and C (6; 4):

- Sketch triangle ABC on the Cartesian plane.
- Show that ABC is an isosceles triangle.
- Determine the co-ordinates of M, the midpoint of AC.
- Determine the gradient of AB.
- Show that the following points are collinear: A, B and D(7;-1)

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10. In the diagram, A is the point (-6;1) and B is the point (0;3)

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Figure 2

- Find the equation of line AB
- Calculate the length of AB
- A' is the image of A and B' is the image of B. Both these images are obtained by applying the transformation: $(x;y) \rightarrow (x-4;y-1)$. Give the coordinates of both A' and B'
- Find the equation of $A'B'$
- Calculate the length of $A'B'$
- Can you state with certainty that $AA'B'B$ is a parallelogram? Justify your answer.

Click here for the solution¹⁰

⁷<http://www.fhsst.org/laY>

⁸<http://www.fhsst.org/lag>

⁹<http://www.fhsst.org/la4>

¹⁰<http://www.fhsst.org/l4o>