



CAMI Mathematics: Grade 10

GRADE 10 CAPS Curriculum

10.8 Analytical geometry

1.1 Distance formula

- Calculate the length of GH, where G is $(-8;-1)$ and H is $(-5;8)$.
- Calculate the length of AB, where A is $(7;1)$ and B is $(-6;7)$.
- Calculate the length of ST, where S is $(4;6)$ and T is $(-4;-6)$.
- Calculate the length of FG, where F is $(-5;4)$ and g is $(-1;7)$.
- Find the value(s) of q if the distance between $L(q;3)$ and $M(1;-1)$ is $\sqrt{17}$.
- Find the value(s) of z if the distance between $D(-8;z)$ and $E(-3;-3)$ is $\sqrt{26}$.
- Find the value(s) of r if the distance between $C(-5;r)$ and $D(-1;-2)$ is $\sqrt{20}$.

1.2 Gradient between two points (parallel and/or perpendicular lines)

- If $A(0;-4)$, $B(-5;-5)$, $C(1;4)$ and $D(2;9)$ are given, calculate the gradients of AB and CD and state whether they are parallel or perpendicular.
- If $K(5;-4)$, $L(0;-8)$, $M(-1;-5)$ and $N(3;-10)$ are given, calculate the gradients of KL and MN and state whether they are parallel or perpendicular.
- If $I(1;-5)$, $J(-3;0)$, $K(g;-4)$ and $L(-3;1)$ are given, calculate the value of g if IJ and KL are parallel.
- $G(1;-4)$, $H(0;-2)$, $I(3;q)$ and $J(1;-1)$ are given, calculate the value of q if GH and IJ are perpendicular.

1.3 Midpoint theorem

- Find the midpoint of the line joining the points $D(-10;-10)$ and $E(5;5)$.
- Find the midpoint of the line joining the points $J(2;-6)$ and $K(-3;-4)$.
- Find the midpoint of the line joining the points $M(-1;-4)$ and $N(-6;-2)$.
- Find the coordinates of the midpoint of the line joining $(-p-9k;6z-7m)$ and $(-7p+7k;2z-7m)$.
- The point $(1;1)$ lies at the centre of a line joining $(-4;7)$ and $(q;-5)$. Find q.
- The point $(5;-1)$ lies at the centre of a line joining $(7;1)$ and $(y;-3)$. Find y.
- The point $(-7;0)$ lies at the centre of a line joining $(-9;-6)$ and $(-5;p)$. Find p.



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MEMO

1.1 Distance formula [8.8.1.1; 8.8.1.2; 8.8.1.3]

(a) G (-8;-1) and H (-5;8)

$$GH = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$GH = \sqrt{(-5 + 8)^2 + (8 + 1)^2}$$

$$GH = \sqrt{3^2 + 9^2}$$

$$GH = \sqrt{9 + 81}$$

$$GH = \sqrt{90}$$

$$GH = 3\sqrt{10}$$

(b) A(7;1) and B(-6;7)

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$AB = \sqrt{(-6 - 7)^2 + (7 - 1)^2}$$

$$AB = \sqrt{(-13)^2 + 6^2}$$

$$AB = \sqrt{169 + 36}$$

$$AB = \sqrt{205}$$

(c) S (4;6) and T(-4;-6)

$$ST = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$ST = \sqrt{(-4 - 4)^2 + (-6 - 6)^2}$$

$$ST = \sqrt{(-8)^2 + (-12)^2}$$

$$ST = \sqrt{64 + 144}$$

$$ST = \sqrt{208}$$

$$ST = 4\sqrt{13}$$



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(d) F(-5;4) and G(-1;7)

$$FG = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$FG = \sqrt{(-1+5)^2 + (7-4)^2}$$

$$FG = \sqrt{(4)^2 + (3)^2}$$

$$FG = \sqrt{16+9}$$

$$FG = \sqrt{25}$$

$$FG = 5$$

(e) L(q;3) and M(1;-1), LM = $\sqrt{17}$

$$LM = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\sqrt{17} = \sqrt{(1-q)^2 + (-1-3)^2}$$

$$\sqrt{17} = \sqrt{1-2q+q^2 + (-4)^2}$$

$$17 = q^2 - 2q + 17$$

$$0 = q^2 - 2q$$

$$0 = q(q - 2)$$

$$q = 0; q = 2$$

(f) D(-8;z) and E(-3;-3), DE = $\sqrt{26}$

$$DE = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\sqrt{26} = \sqrt{(-3+8)^2 + (-3-z)^2}$$

$$\sqrt{26} = \sqrt{(5)^2 + 9 + 6z + z^2}$$

$$26 = z^2 + 6z + 34$$

$$0 = z^2 + 6z + 8$$

$$0 = (z+4)(z+2)$$

$$z = -4; z = -2$$



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(g) C(-5;r) and D(-1;-2), $CD = \sqrt{20}$

$$CD = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\sqrt{20} = \sqrt{(-1+5)^2 + (-2-r)^2}$$

$$\sqrt{20} = \sqrt{(4)^2 + 4 + 4r + r^2}$$

$$20 = r^2 + 4r + 20$$

$$0 = r^2 + 4r$$

$$0 = r(r+4)$$

$$r = 0; r = -4$$

1.2 Gradient between two points (parallel and/or perpendicular lines) [8.8.4.1; 8.8.4.2]

(a) If A(0;-4) , B(-5;-5) , C(1;4) and D(2;9)

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{AB} = \frac{-5 - 0}{-5 - 4}$$

$$m_{AB} = \frac{-5}{-1}$$

$$m_{AB} = 5$$

$$m_{CD} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{CD} = \frac{9 - 4}{2 - 1}$$

$$m_{CD} = \frac{5}{1}$$

$$m_{CD} = 5$$

$$m_{AB} = m_{CD}$$
$$\therefore AB \parallel CD$$

(b) If K(5;-4) , L(0;-8) , M(-1;-5) and N(3;-10)

$$m_{KL} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{KL} = \frac{-8 + 4}{0 - 5}$$

$$m_{KL} = \frac{-4}{-5}$$

$$m_{KL} = \frac{4}{5}$$

$$m_{MN} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{MN} = \frac{-10 + 5}{3 + 1}$$

$$m_{MN} = \frac{-5}{4}$$

$$m_{KL} \times m_{MN} = -1$$

$$\therefore KL \perp MN$$



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(c) If I(1;-5), J(-3;0), K(g;-4) and L(-3;1)

$$m_{IJ} = m_{KL}$$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{0+5}{-3-1} = \frac{1+4}{-3-g}$$

$$\frac{5}{-4} = \frac{5}{-3-g}$$

$$5(-3-g) = -20$$

$$-15-5g = -20$$

$$-5g = -5$$

$$\therefore g = 1$$

(d) G(1;-4) , H(0;-2) , I(3 ;q) and J(1;-1)

$$m_{GH} \times m_{IJ} = -1$$

$$\frac{-2+4}{0-1} \times \frac{-1-q}{1-3} = -1$$

$$\frac{2}{-1} \times \frac{-1-q}{-2} = -1$$

$$\frac{-1-q}{-2} = \frac{1}{2}$$

$$2(-1-q) = -2$$

$$-1-q = -1$$

$$-q = 0$$

$$\therefore q = 0$$

1.3 Midpoint theorem [8.8.2.1; 8.8.2.2; 8.8.2.3]

a) D(-10;-10) and E(5;5)

$$M(x; y) = \left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2} \right)$$

$$M(x; y) = \left(\frac{5-10}{2}; \frac{5-10}{2} \right)$$

$$M(x; y) = \left(\frac{-5}{2}; \frac{-5}{2} \right)$$

(b) J(2;-6) and K(-3;-4)



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$$M(x; y) = \left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2} \right)$$

$$M(x; y) = \left(\frac{-3+2}{2}; \frac{-4-6}{2} \right)$$

$$M(x; y) = \left(\frac{-1}{2}; \frac{-10}{2} \right)$$

$$M(x; y) = \left(-\frac{1}{2}; -5 \right)$$

(c) M(-1;-4) and N(-6;-2)

$$M(x; y) = \left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2} \right)$$

$$M(x; y) = \left(\frac{-6-1}{2}; \frac{-2-4}{2} \right)$$

$$M(x; y) = \left(\frac{-7}{2}; \frac{-6}{2} \right)$$

$$M(x; y) = \left(-\frac{7}{2}; -3 \right)$$

(d) (-p-9k;6z-7m) and (-7p+7k;2z-7m)

$$M(x; y) = \left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2} \right)$$

$$M(x; y) = \left(\frac{-p-9k-7p+7k}{2}; \frac{6z-7m+2z-7m}{2} \right)$$

$$M(x; y) = \left(\frac{-8p-2k}{2}; \frac{8z-14m}{2} \right)$$

$$M(x; y) = (-4p-k; 4z-7m)$$

(e)

$$x = \frac{x_2 + x_1}{2}$$

$$1 = \frac{-4+q}{2}$$

$$2 = -4+q$$

$$q = 6$$



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(f)

$$x = \frac{x_2 + x_1}{2}$$

$$5 = \frac{7 + y}{2}$$

$$10 = 7 + y$$

$$y = 3$$

(g)

$$y = \frac{y_2 + y_1}{2}$$

$$0 = \frac{-6 + p}{2}$$

$$0 = -6 + p$$

$$p = 6$$

