Solutions by
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# GCSE (9-1) Grade 8/9
# Equations of Perpendicular lines

**Unfinished. Please support to inspire me on.**

**Instructions**

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions.

Answer the questions in the spaces provided
  – there may be more space than you need.

- **Show all your working out**

**Information**

- The total mark for this paper is 75.
- The marks for **each** question are shown in brackets.
  – use this as a guide as to how much time to spend on each question.
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed

**Advice**

- Read each question carefully before you start to answer it
- Attempt every question
- Check your answers if you have time at the end

**1.** Here are the equations of 5 straight lines:

A: $y = 3x + 2$

B: $y = \frac{1}{3}x + 2$

C: $y = -\frac{1}{3}x + 4$

D: $3y - 6 - x = 0$

E : $3x - y - 2 = 0$

F: $x + 3y - 6 = 0$

D: $3y = x + 6$

$y = \frac{1}{3}x + 2$

E: $y = 3x - 2$

F: $3y = -x - 6$

$y = -\frac{1}{3}x - 2$

(a) Write down the letter of the line that is parallel to $y = 3x - 5$

(same gradient) E

**(2)**

(b) Write down the letter of the line that is perpendicular to $y = 3x - 2$

F

**(2)**

(c) Write down the letter of the line that is perpendicular to $y = -3x + 5$

B

**(2)**

**2.** The straight line $L$ has equation $y = 6x - 9$

Find an equation of the straight line perpendicular to $L$ which passes through (0, 1).

$y = 6x - 9$ $\quad m = 6$

$y = -\frac{1}{6}x + c$ $\quad m = -\frac{1}{6}$

$1 = -\frac{1}{6}(0) + c$

$c = 1$

$y = -\frac{1}{6}x + 1$

**(Total 3 marks)**

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**3.** Find the equation of the line that passes through the point (-2, 5) and is perpendicular to the line $y = 3x + 6$

$y = 3x + 6$ $\quad m = 3$

$y = -\frac{1}{3}x + c$ $\quad m = -\frac{1}{3}$

$5 = -\frac{1}{3}(-2) + c$

$5 = \frac{2}{3} + c$

$c = 4\frac{1}{3}$

$y = -\frac{1}{3}x + 4\frac{1}{3}$

**(Total 3 marks)**

**4.** Find an equation of the line that passes through the point (3, 4) and is perpendicular to the line $4x - 6y + 7 = 0$

$4x - 6y + 7 = 0$

$6y = 4x + 7$

$y = \frac{4}{6}x + \frac{7}{6}$

$m = \frac{4}{6} = \frac{2}{3}$

$y = -\frac{3}{2}x + c$

$4 = -\frac{3}{2}(3) + c$

$4 = -\frac{9}{2} + c$

$c = 8.5$

$y = -\frac{3}{2}x + 8.5$

**(Total 3 marks)**

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**5.** Find an equation of the line that passes through the point (5, -5) and is perpendicular to the line $y = \frac{2}{3}x + 5$. Write your answer in the form $ax + by + c = 0$, where $a, b$ and $c$ are integers

$y = \frac{2}{3}x + 5$

$m = \frac{2}{3}$

$m = -\frac{3}{2}$

$y = -\frac{3}{2}x + c$

$-5 = -\frac{3}{2}(5) + c$

$-5 = -\frac{15}{2} + c$

$c = \frac{5}{2}$

$y = -\frac{3}{2}x + \frac{5}{2}$

$2y = -3x + 5$

$2y + 3x - 5 = 0$

**(Total 4 marks)**

**6.** *A* is the point with coordinates (1, 3)
*B* is the point with coordinates (4, −1)
The straight line *L* goes through both *A* and *B*.

Is the line with equation $2y = 3x - 4$ perpendicular to line *L*?
You must show how you got your answer.

$m = \frac{-1-3}{4-1} = -\frac{4}{3}$ ← not perpendicular

$2y = 3x - 4$

$y = \frac{3}{2}x - 2$ $\quad m = \frac{3}{2}$

**(Total 4 marks)**

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**7.** The line $l$ passes through the points (-3, 0) and (3, -2) and the line $n$ passes through the points (1, 8) and (-1, 2)
Show that the line $l$ and $n$ are perpendicular

$m = \frac{-2-0}{3--3} = -\frac{2}{6} = -\frac{1}{3}$

perpendicular gradient is 3

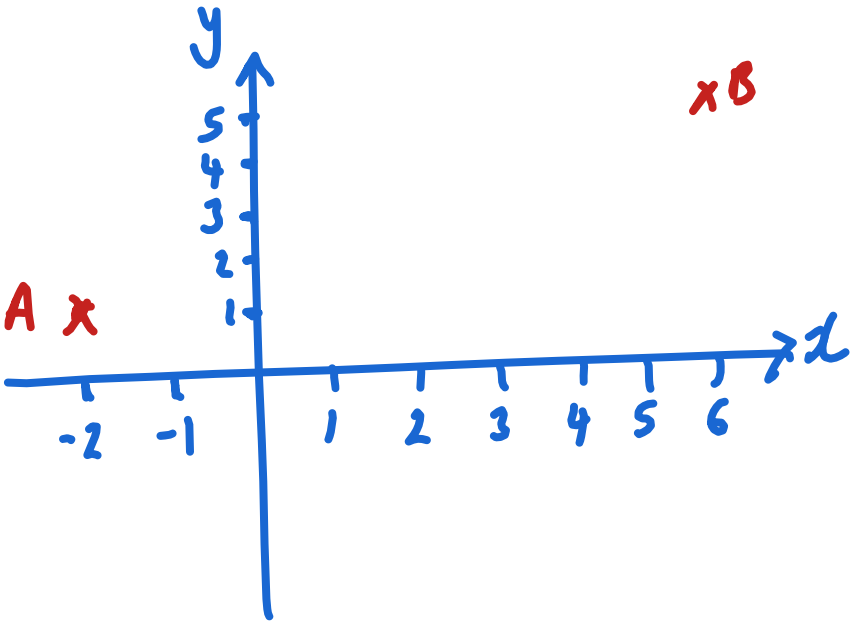
$m = \frac{2-8}{-1-1} = \frac{-6}{-2} = 3$

So they are perpendicular

**(Total 4 marks)**

**8.** $A(-2,\ 1), B(6,\ 5)$, and $C(4,\ k)$ are the vertices of a right-angled triangle *ABC*. Angle *ABC* is the right angle.

Find an equation of the line that passes through *A* and *C*.
Give your answer in the form $ay + bx = c$ where *a, b* and *c* are integers.




**(Total 5 marks)**

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**9.** The vertices of a quadrilateral ABCD have coordinates A(-1, 5), B(7, 1), C(5, -3) and D(-3, 1).
Show that the quadrilateral is a rectangle

**(Total 5 marks)**

**10.** The line $m$ has equation $x - 2y - 4p = 0$

The line $n$ has equation $px - y + 9 = 0$

$p$ is a constant.

Given that lines $m$ and $n$ are perpendicular, find the coordinates of the point where they intersect

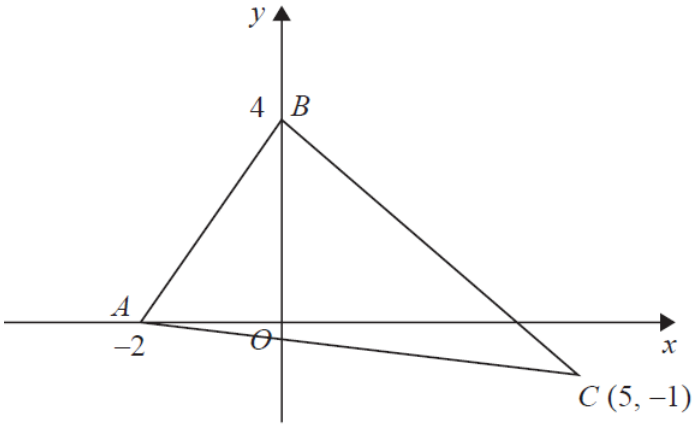
**(Total 5 marks)**

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**11.** Show that line $5x - y + 2 = 0$ is perpendicular to line $2x + 10y - 4 = 0$

**(Total 4 marks)**

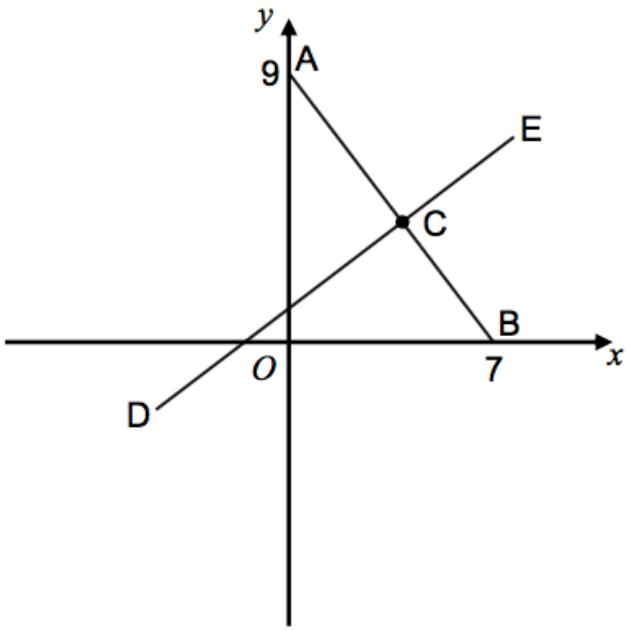
**12.**




Find an equation of the line that passes through *C* and is perpendicular to *AB*.

**(Total 4 marks)**

**13.**

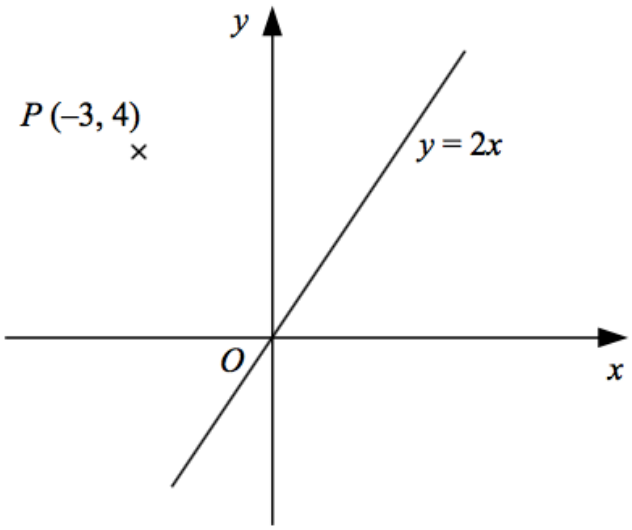



**Not Drawn Accurately**

C is the midpoint of AB.
DCE is perpendicular to ACB.
Work out the equation of the line DCE.

**(Total 5 marks)**

**14.**

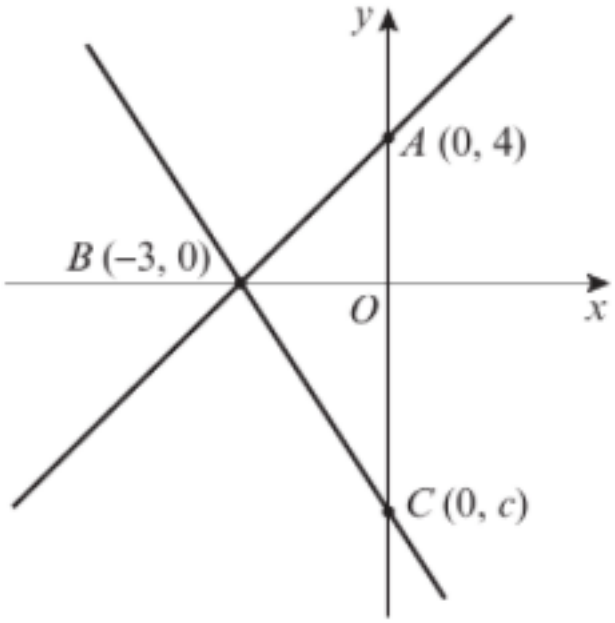



The diagram shows the point *P* with coordinates (-3, 4) and the line with equation $y = 2x$

The point *Q* is such that the line $y = 2x$ is the perpendicular bisector of *PQ*
Find the coordinates of *Q*

**(Total 5 marks)**

**15.** The points *A* and *C* lie on the y-axis and the point *B* lies on the $x$ -axis as shown in the diagram




The line through points *A* and *B* is perpendicular to the line through points *B* and *C*. Find the value of c

**(Total 5 marks)**

**15.**

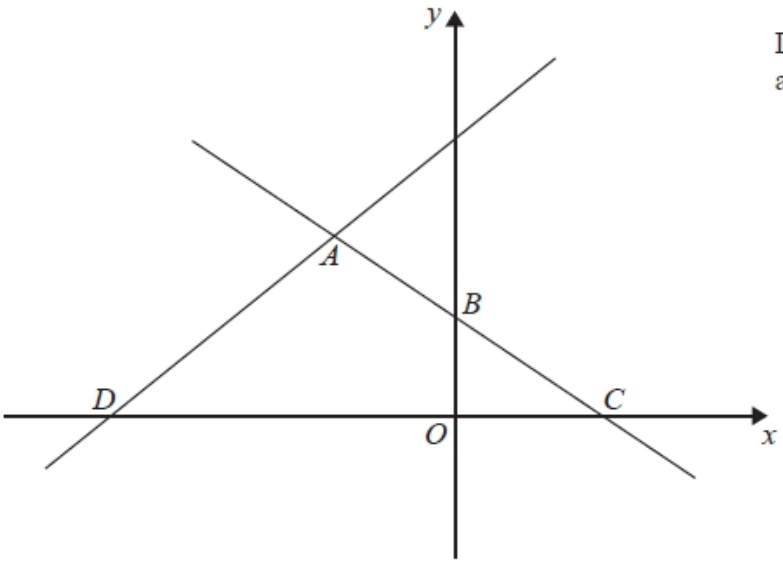



Diagram **NOT** accurately drawn

In the diagram, *ABC* is the line with equation $y = \frac{1}{2}x + 5$

*AB* = *BC*

*D* is the point with coordinates (−13, 0)

Find an equation of the line through *A* and *D*.

**(Total 5 marks)**

**16.** *P* has coordinates (–9, 7)
*Q* has coordinates (11, 12)

*M* is the point on the line segment *PQ* such that *PM* : *MQ* = 2 : 3

Line **L** is perpendicular to the line segment *PQ*.
**L** passes through *M*.

Find an equation of **L**.

**(Total 5 marks)**

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**TOTAL FOR PAPER: 75 MARKS**