

PARALLEL AND PERPENDICULAR LINES - PRACTICE QUESTIONS



1.

Write down the gradient of lines perpendicular to:

(a) $y = 3x + 10$

$-1/3$

(b) $y = 4x - 11$

$-1/4$

(c) $y = -2x + 7$

$1/2$

(d) $y = 10 - 7x$

$1/7$

(e) $y = \frac{1}{2}x - 4$

-2

(f) $y = \frac{3}{4}x + 9$

$-4/3$

(g) $y = -\frac{7}{2}x + \frac{1}{2}$

$2/7$

(h) $y = -\frac{4}{5}x - \frac{1}{5}$

$5/4$

(i) $2y = 5x - 10$

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

$-2/5$

(j) $3y = 1 - x$

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

3

(k) $5y = 3x - 12$

$y = \frac{3}{5}x - \frac{12}{5}$

$-\frac{5}{3}$

(l) $9y = -8x + 13$

$y = -\frac{8}{9}x + \frac{13}{9}$

$\frac{9}{8}$

(m) $10y = 6x + 19$

$y = \frac{6}{10}x + \frac{19}{10}$

$-\frac{10}{6} = -\frac{5}{3}$

(n) $2y = \frac{1}{5}x + 8$

$y = \frac{1}{10}x + 4$

-10

(o) $3y = -\frac{3}{8}x + 12$

$y = -\frac{1}{8}x + 4$

8

2.

Line L has equation $y = 2x + 11$.

(a) Circle the equation of the line that is parallel to L.

$y = 3x + 11$

$y = 2x + 3$

$y = -\frac{1}{2}x + 9$

$y = \frac{1}{2}x - 5$

(b) Circle the equation of the line that is perpendicular to L.

$y = 3x + 11$

$y = 2x + 3$

$y = -\frac{1}{2}x + 9$

$y = \frac{1}{2}x - 5$

3.

Line A has equation $y = \frac{3}{2}x + 9$.

(a) Circle the equation of the line that is parallel to A.

$y = 2x + 5$

$y = -\frac{3}{2}x + 13$

$y = -\frac{2}{3}x + 11$

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

(b) Circle the equation of the line that is perpendicular to A.

$y = 2x + 5$

$y = -\frac{3}{2}x + 13$

$y = -\frac{2}{3}x + 11$

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

4.

Line B has equation $y = 9 - 10x$.

(a) Circle the equation of the line that is parallel to B.

$y = -10x + 11$

$y = -\frac{1}{10}x + 4$

$y = -\frac{1}{9}x + 7$

$y = \frac{1}{10}x - \frac{1}{9}$

(b) Circle the equation of the line that is perpendicular to B.

$y = -10x + 11$

$y = -\frac{1}{10}x + 4$

$y = -\frac{1}{9}x + 7$

$y = \frac{1}{10}x + 5$

5.

Line C has equation $2y = 5x - 7$.

$y = \frac{5}{2}x - \frac{7}{2}$

(a) Circle the equation of the line that is perpendicular to C.

$y = -\frac{2}{5}x + 10$

$y = \frac{2}{5}x + 20$

$y = -\frac{5}{2}x + 11$

$y = \frac{5}{2}x + 9$

(b) Circle the equation of the line that is parallel to C.

$y = -\frac{2}{5}x + 10$

$y = \frac{2}{5}x + 20$

$y = -\frac{5}{2}x + 11$

$y = \frac{5}{2}x + 9$

6.

Find the equation of the line that is parallel to $y = 3x + 10$ and passes through the point $(2, 11)$.

$$y = 3x + c$$

$$(2, 11): 11 = 3 \times 2 + c$$

$$11 = 6 + c$$

$$c = 5$$

$$\underline{y = 3x + 5}$$

7.

Find the equation of the line that is perpendicular to $y = 4x - 1$ and passes through the point $(8, 5)$.

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

$$(8, 5): 5 = -\frac{1}{4} \times 8 + c$$

$$5 = -2 + c$$

$$c = 7$$

$$\underline{y = -\frac{1}{4}x + 7}$$

8.

Find the equation of the line that is parallel to $y = 6x + 6$ and passes through the point $(-1, 7)$.

$$y = 6x + c$$

$$(-1, 7): 7 = 6 \times -1 + c$$

$$7 = -6 + c$$

$$c = 13$$

$$\underline{y = 6x + 13}$$

9.

Find the equation of the line that is perpendicular to $y = \frac{3}{2}x + 3$ and passes through the point $(12, -1)$.

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

$$(12, -1): -1 = -\frac{2}{3} \times 12 + c$$

$$-1 = -\frac{24}{3} + c$$

$$-1 = -8 + c$$

$$c = 7$$

$$\underline{y = -\frac{2}{3}x + 7}$$

10.

Line A passes through the points (1, 2) and (5, 18).

Line B passes through the points (7, 3) and (9, 11).

Are lines A and B parallel, perpendicular or neither?

$$\text{gradient of A} = \frac{18-2}{5-1} = \frac{16}{4} = 4$$

$$\text{gradient of B} = \frac{11-3}{9-7} = \frac{8}{2} = 4$$

Parallel

11.

Line C passes through the points (2, 5) and (6, 7).

Line D passes through the points (8, 2) and (5, -4).

Are lines C and D parallel, perpendicular or neither?

$$\text{gradient of C} = \frac{7-5}{6-2} = \frac{2}{4} = \frac{1}{2}$$

$$\text{gradient of D} = \frac{-4-2}{5-8} = \frac{-6}{-3} = 2$$

Neither

12.

Line E passes through the points (7, 3) and (10, -5).

Line F passes through the points (-2, -1) and (14, 5).

Are lines E and F parallel, perpendicular or neither?

$$\text{gradient of E} = \frac{-5-3}{10-7} = \frac{-8}{3}$$

$$\text{gradient of F} = \frac{5-(-1)}{14-(-2)} = \frac{6}{16} = \frac{3}{8}$$

Perpendicular.

13.

Below are the equations of five straight lines - A, B, C, D and E.

Line A $y = 4x - 9$

Line B $2y = 4x + 11 \rightarrow y = \frac{4x}{2} + \frac{11}{2} \rightarrow y = 2x + \frac{11}{2}$

Line C $4y = 15 - x \rightarrow y = \frac{15}{4} - \frac{1}{4}x$

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

Line E $y = \frac{2}{3}x$

gradients
A = 4
B = 2
C = $-\frac{1}{4}$
D = $\frac{2}{3}$
E = $\frac{2}{3}$

(a) Write down the letters of the two lines that are parallel.

D and E

(b) Write down the letters of the two lines that are perpendicular.

A and C

14.

Below are the equations of five straight lines - M, N, O, P and Q.

Line M $y = 3x + 5$

Line N $2y + 5x - 10 = 0 \rightarrow 2y = -5x + 10 \rightarrow y = -\frac{5}{2}x + 5$

Line O $3y + x - 3 = 0 \rightarrow 3y = -x + 3 \rightarrow y = -\frac{1}{3}x + 1$

Line P $4y - 10x - 5 = 0 \rightarrow 4y = 10x + 5 \rightarrow y = \frac{10}{4}x + \frac{5}{4}$

Line Q $y = -\frac{5}{2}x + 1$

gradients
M = 3
N = $-\frac{5}{2}$
O = $-\frac{1}{3}$
P = $\frac{5}{2}$ Q = $-\frac{5}{2}$

\downarrow
 $y = \frac{5}{2}x + \frac{5}{4}$

(a) Write down the letters of the two lines that are parallel.

N and Q

(b) Write down the letters of the two lines that are perpendicular.

M and O

15.

Line Z passes through the points (1, 5) and (5, 17).

Line Q is parallel to Line Z and passes through the point (4, 2).

Find the equation of Line Q.

$$\text{gradient of Z} = \frac{17-5}{5-1} = \frac{12}{4} = 3$$

$$y = 3x + c$$

$$(4, 2): 2 = 3 \times 4 + c$$

$$2 = 12 + c$$

$$c = -10$$

$$\underline{y = 3x - 10}$$

16.

Line R passes through the points (2, 3) and (5, -6).

Line Q is perpendicular to Line R and passes through the point (6, 10).

Find the equation of Line Q.

$$\text{gradient of R} = \frac{-6-3}{5-2} = \frac{-9}{3} = -3$$

$$\text{gradient of Q} = \frac{1}{3}$$

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

$$(6, 10): 10 = \frac{1}{3} \times 6 + c$$

$$10 = 2 + c$$

$$c = 8$$

$$\underline{y = \frac{1}{3}x + 8}$$

17.

Line S passes through the points (3, 1) and (6, -3).

Line T is parallel to Line S and passes through the point (15, 6).

Find the equation of Line T.

$$\text{gradient of S} = \frac{-3-1}{6-3} = \frac{-4}{3}$$

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

$$(15, 6): 6 = -\frac{4}{3} \times 15 + c$$

$$6 = -\frac{60}{3} + c$$

$$6 = -20 + c$$

$$c = 26$$

$$\underline{y = -\frac{4}{3}x + 26}$$

18.

$$A = (-2, -4)$$

$$B = (3, 0)$$

$$C = (12, 3)$$

Find the equation of the line perpendicular to AB that passes through point C.

$$\text{gradient of } AB = \frac{-4 - 0}{-2 - 3} = \frac{-4}{-5} = \frac{4}{5}$$

$$y = -\frac{5}{4}x + c$$

$$(12, 3): 3 = -\frac{5}{4} \times 12 + c$$

$$3 = \frac{-60}{4} + c$$

$$3 = -15 + c$$

$$c = 18$$

$$\underline{y = -\frac{5}{4}x + 18}$$

19.

$$X = (3, 10)$$

$$Y = (-5, 8)$$

$$Z = (5, 5)$$

Find the equation of the line perpendicular to XZ that passes through point Y.

$$\text{gradient of } XZ = \frac{10 - 5}{3 - 5} = \frac{5}{-2} = -\frac{5}{2}$$

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

$$(-5, 8): 8 = \frac{2}{5} \times -5 + c$$

$$8 = -2 + c$$

$$c = 10$$

$$\underline{y = \frac{2}{5}x + 10}$$

20.

Pictured to the right is a straight line L and points P and Q.

(a) Find the equation of the line L.

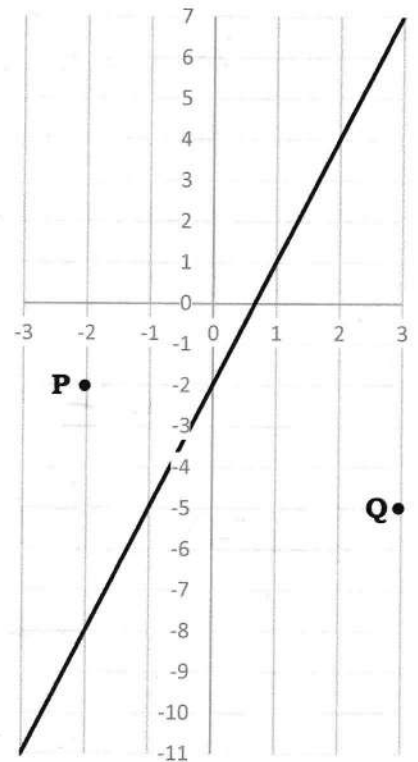
$$y = 3x - 2$$

(b) Find the equation of the line that is parallel to L and passes through P.

$$y = 3x + c$$

$$\begin{aligned} (-2, -2): -2 &= 3x - 2 + c \\ -2 &= -6 + c \\ c &= 4 \end{aligned}$$

$$\underline{y = 3x + 4}$$



(c) Find the equation of the line that is perpendicular to L and passes through Q.

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

$$\begin{aligned} (3, -5): -5 &= -\frac{1}{3} \times 3 + c \\ -5 &= -1 + c \\ -4 &= c \end{aligned}$$

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

21.

The line W has equation $3y = 4x - 11$.

The line V is perpendicular to W and passes through the point $(-4, 7)$.

Does V pass through the point $(\frac{2}{3}, \frac{7}{2})$?

$$W: y = \frac{4}{3}x - \frac{11}{3}$$

$$\text{gradient of } V = -\frac{3}{4}$$

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

$$(-4, 7): 7 = -\frac{3}{4}x - 4 + c$$

$$7 = 3 + c$$

$$c = 4$$

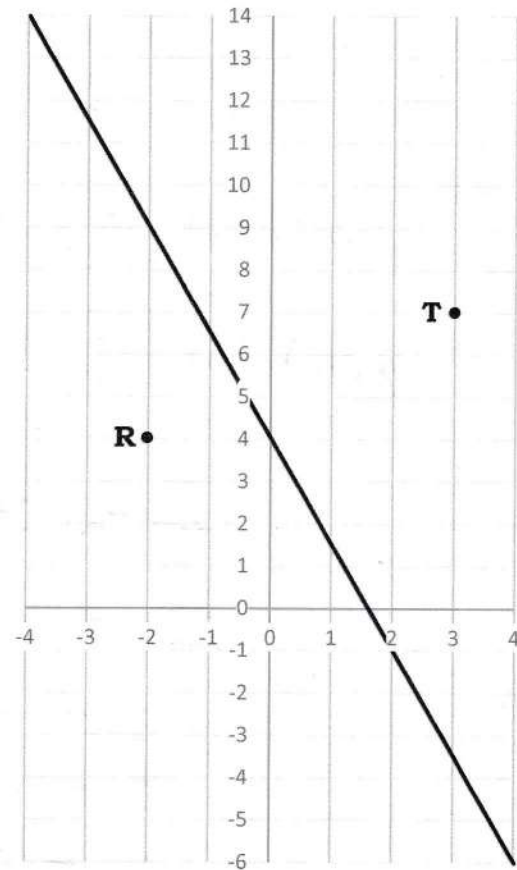
$$y = -\frac{3}{4}x + 4$$

$$\begin{aligned} (\frac{2}{3}, \frac{7}{2}): \frac{7}{2} &= -\frac{3}{4} \times \frac{2}{3} + 4 \\ &= -\frac{1}{2} + 4 = \frac{7}{2} \end{aligned}$$

Yes

22.

Pictured to the right is the straight line S_1 and the points R and T.



(a) Find the equation of S_1 .

$$y = -\frac{5}{2}x + 4$$

(b) S_2 is perpendicular to S_1 and passes through R. Find the equation of S_2 .

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

$$(-2, 4): 4 = -\frac{4}{5} + c$$

$$c = \frac{24}{5}$$

$$\underline{y = \frac{2}{5}x + \frac{24}{5}}$$

(c) Does S_2 pass through T?

$$\begin{aligned} (3, 7): 7 &= \frac{6}{5} + \frac{24}{5} = \frac{30}{5} \\ &= 6 \end{aligned} \quad \underline{\text{No}}$$

23.

$$A = (-3, -2)$$

$$B = (6, 4)$$

The line C has equation $4y + 6x = 13$.

Show that C is perpendicular to AB.

$$\text{gradient of AB} = \frac{-2 - 4}{-3 - 6} = \frac{-6}{-9} = \frac{2}{3}$$

$$\begin{aligned} C: 4y &= -6x + 13 \\ y &= -\frac{6}{4}x + \frac{13}{4} \\ y &= -\frac{3}{2}x + \frac{13}{4} \end{aligned}$$

$\frac{2}{3}$ and $-\frac{3}{2}$ are negative reciprocals of each other, so C and AB are perpendicular.

24.

Line I passes through the points (5, 6) and (8, -3).

Line J passes through the points (-2, -2) and (4, k).

Lines I and J are perpendicular.

Find k.

$$\text{gradient of I} = \frac{6 - (-3)}{5 - 8} = \frac{9}{-3} = -3$$

$$\text{gradient of J} = \frac{-2 - k}{-2 - 4} = \frac{-2 - k}{-6}$$

$$\frac{1}{3} = \frac{-2 - k}{-6}$$

$$\frac{-6}{3} = -2 - k$$

$$-2 = -2 - k$$

$$0 = -k$$

$$\underline{k = 0}$$

25.

Line F crosses the y-axis at $y = 5$ and crosses the x-axis at $x = 2$. $\rightarrow (0, 5)$ and $(2, 0)$

Line G passes through the points $(1, \frac{12}{5})$ and $(m, 4)$.

Lines F and G are perpendicular.

Find m.

$$\text{gradient of F} = \frac{5 - 0}{0 - 2} = \frac{5}{-2} = -\frac{5}{2}$$

$$\text{gradient of G} = \frac{4 - \frac{12}{5}}{m - 1} = \frac{\frac{20}{5} - \frac{12}{5}}{m - 1} = \frac{\frac{8}{5}}{m - 1}$$

$$\begin{aligned} \times 5 \quad \frac{2}{5} &= \frac{8/5}{m-1} \quad \times 5 \\ 2 &= \frac{8}{m-1} \end{aligned}$$

$$2(m-1) = 8$$

$$2m - 2 = 8$$

$$2m = 10$$

$$m = 5$$