Perpendicular Lines

$O A$ has gradient $\frac{1}{3}$
OB has gradient -3
Perpendicluar gradients multiply to -1

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

To find a gradient perpendicular to another gradient simply take the negative reciprocal

Examples $\frac{2}{3}$ and $-\frac{3}{2}$
-2 and $\frac{1}{2}$
$-\frac{4}{5}$ and $\frac{5}{4}$
$\frac{1}{3}$ and -3
$-\frac{8}{3}$ and $\frac{3}{8}$
+1 and -1

Decide whether the following pairs of lines are perpendicular

1) $\left\{\begin{array}{l}y=3 x+1 \\ y=-3 x+2\end{array} \quad\right.$ No not 1
2) $\left\{\begin{array}{l}y=\frac{4}{3} x \\ y=-\frac{3}{4} x+7\end{array}\right.$ yes 1
3) $\left\{\begin{array}{l}y=-x \\ y=\frac{1}{2} x+1\end{array} \quad\right.$ No not 1
4) $\left\{\begin{array}{l}y=\frac{2}{3} x-4 \\ y=\frac{3}{2} x+4\end{array}\right.$ No not 1
5) $\left\{\begin{array}{l}y=\frac{1}{4} x-2 \\ y=4 x+1\end{array}\right.$ No not 1
6) $\left\{\begin{array}{l}y=\frac{5}{2} x+1 \\ y=-\frac{2}{5} x+3\end{array}\right.$ y es 1
7) $\left\{\begin{array}{l}y=-\frac{4}{2} x-7 \\ y=-\frac{7}{4} x+7\end{array}\right.$ No not $\perp$

Finding Ens of Perpendicular Lines
Ex Find equ of line perpendicular to $y=2 x+3$ passing through $(4,7)$

Line is of the form $y=-\frac{1}{2} x+c$
$5, b$
$(4,7)$

$$
\begin{gathered}
7=-\frac{1}{2}(4)+c \\
7=-2+c \\
7+2=c \\
9=c
\end{gathered}
$$



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

1.) Find equ of line perpendicular to $y=-\frac{5}{3} x-4$ passing through $(-10,7)$

Line is of the form $y=\frac{3}{5} x+c$

Sub
$(-10,7)$

$$
\begin{aligned}
7 & =\frac{3}{5}(-10)+c \\
7 & =-6+c \\
7+6 & =c \\
13 & =c \quad y=\frac{3}{5} x+13
\end{aligned}
$$

2) Find equ of line perpendicular to $y=\frac{1}{4} x-3$ passing through $(4,-1)$

Line is of form $y=-4 x+c$

$$
\begin{aligned}
\text { Sub } & -1 \\
(4,-1) & \\
& -1 \\
& =-16+4)+c \\
-1+16 & =-c \\
& +15=c
\end{aligned}
$$

$$
y=-4 x+15
$$

3) Find eqn of line perpendicular to $y=x+4$ passing through $(-3,-2)$

Line is of form $y=-x+c$

Sub

$$
(-3,-2)
$$

$$
\begin{aligned}
-2 & =-(-3)+c \\
-2 & =+3+c \\
-2-3 & =c \\
-5 & =c
\end{aligned}
$$

$$
y=-x-5
$$

4) Find equ of line perpendicular to $y=\frac{7}{3} x-1$ passing through $(14,3)$

Line is of form $y=-\frac{3}{7} x+c$

$$
\begin{array}{ll}
\text { Sub } & \begin{array}{l}
3 \\
(14,3)
\end{array} \\
& =-\frac{3}{7}(14)+c \\
3 & =-6+c \\
3+6 & =c \\
9 & =c \quad y=-\frac{3}{7} x+9
\end{array}
$$

5) Find equs of two lines, one parallel to and one perpendicular to, the line $y=\frac{2}{5} x+4$ Both lines to pass through the point $(-10,1)$

Parallel line of form

$$
\operatorname{Sub}(-10,1)
$$

$$
\begin{aligned}
& y=\frac{2}{5} x+c \\
& 1=\frac{2}{5}(-10)+c \\
& 1=-4+c \\
& 1+4=c \\
& 5=c
\end{aligned}
$$

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

Perpendicular line of form $y=-\frac{5}{2} x+c$

$$
\begin{array}{ll}
\operatorname{Sub}(-10,1) & 1=-\frac{5}{2}(-10)+c \\
1=25+c \\
y=-\frac{5}{2} x-24 & 1-25=c \\
& -24=c
\end{array}
$$



