MASTER COACHING

NAME

NUMBER PLANES

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Edition 1

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MASTER COACHING

Number Plane

Number plane is geometry, with visual properties made clear by accurate graphs.

The x axis should be drawn on a line of the page.
The scale along the y axis should also fall on the lines of the page.
These two ideas are essential to drawing accurate graphs for most students.

The scale along the x axis could be marked in centimetres.
If the same scale is required on both axes, tear a small strip of paper from the side of the page, rotate it through 90 degrees, and use the line markings to set the scale along the x axis at line widths.

Plotting points : a 'point' is a *location* on a plane, indicated by a capital letter.

The point P which is x units sideways and has a height of y has its location written as $P(x, y)$

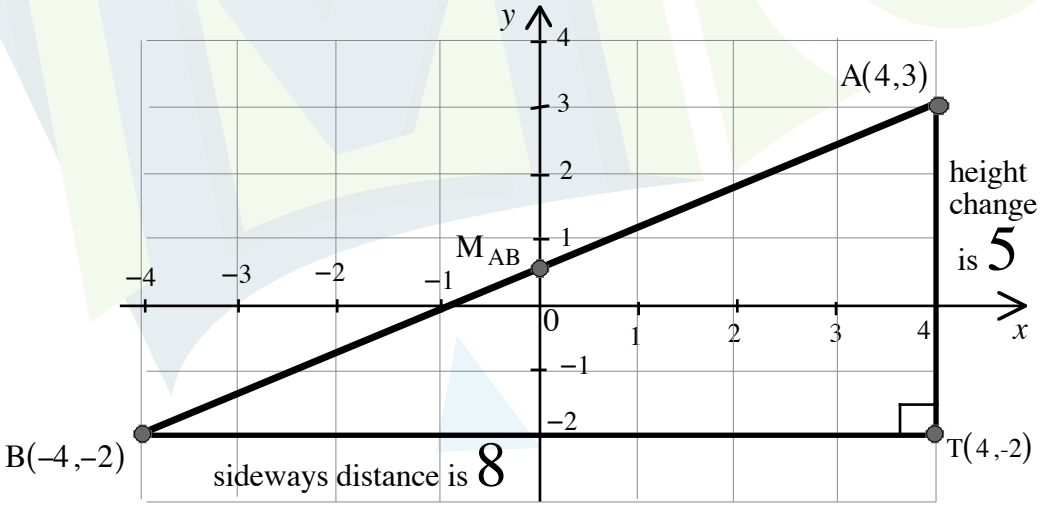
eg $Q(3,7)$ indicates that Q is 3 units to the *positive righthand* side of the vertical y axis and then the positive height of 7 units is above the horizontal x axis

ie (x, y) means (*sideways*, *height*)

We must be able to find the length, slope and midpoint of a line joining *two points*.

The equation of the line is not as obvious from the diagram ... see page 4.

Two points ... consider $A(4,3)$ and $B(-4,-2)$ shown plotted on the number plane below :



In the diagram above, I have labeled a point T. Check that its coordinates are $T(4,-2)$
You can see that you have a right-angled triangle ABT, good for Pythagoras.
You need to understand how to get the horizontal length BT and the vertical length AT.

BT is the distance when you go from 4 units to the left of the origin to 4 units on the right.
You can think 'BT=4+4=8' or you can think '$BT = 4-(-4) = 4+4 = 8$'

AT is the distance when you go from 2 units 'below ground' to 3 units 'above ground'.
You can think 'AT=2+3=5' or you can think '$AT = 3-(-2) = 3+2 = 5$'

Length, slope and midpoint depend upon getting these two lengths correct.

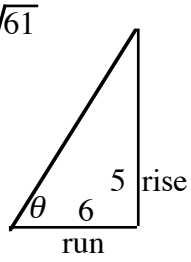
Number Plane ... Exercise Set 1 ... Two-Point Measurements **Answers**

1 a $AB = \sqrt{5^2 + 6^2} = \sqrt{61}$

b $m_{AB} = \frac{5}{6}$

c $6y = 5x + 8$

d $M_{AB} = \left(-1, \frac{1}{2}\right)$



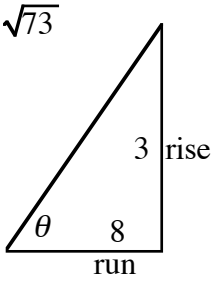
e $y = 1\frac{1}{3}$ **f** $\theta = \tan^{-1}\left(\frac{5}{6}\right) = 39 \cdot 8°$

2 a $AB = \sqrt{8^2 + 3^2} = \sqrt{73}$

b $m_{AB} = \frac{3}{8}$

c $8y = 3x + 17$

d $M_{AB} = \left(1, 2\frac{1}{2}\right)$



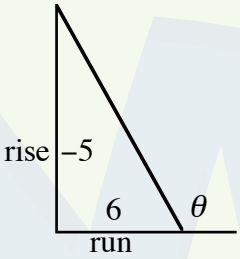
e $y = 2\frac{1}{8}$ **f** $\theta = \tan^{-1}\left(\frac{3}{8}\right) = 20 \cdot 6°$

3 a $AB = \sqrt{5^2 + 6^2} = \sqrt{61}$

b $m_{AB} = \frac{-5}{6}$

c $6y = -5x + 16$

d $M_{AB} = \left(-1, 3\frac{1}{2}\right)$



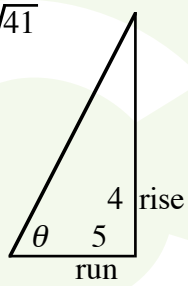
e $y = 2\frac{2}{3}$ **f** $\theta = 140 \cdot 2°$

4 a $AB = \sqrt{4^2 + 5^2} = \sqrt{41}$

b $m_{AB} = \frac{4}{5}$

c $5y = 4x - 19$

d $M_{AB} = \left(3\frac{1}{2}, -1\right)$



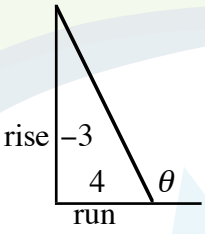
e $y = -3\frac{4}{5}$ **f** $\theta = 38 \cdot 7°$

5 a $AB = \sqrt{3^2 + 4^2} = 5$

b $m_{AB} = \frac{-3}{4}$

c $4y = -3x + 19$

d $M_{AB} = \left(3, 2\frac{1}{2}\right)$



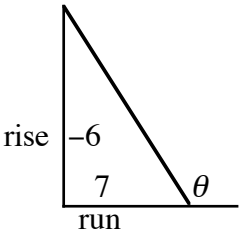
e $y = 4\frac{3}{4}$ **f** $\theta = 143 \cdot 1°$

6 a $AB = \sqrt{6^2 + 7^2} = \sqrt{85}$

b $m_{AB} = -\frac{6}{7}$

c $7y = -6x + 16$

d $M_{AB} = \left(1\frac{1}{2}, 1\right)$



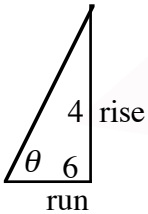
e $y = 2\frac{2}{7}$ **f** $\theta = 139 \cdot 4°$

7 a $AB = \sqrt{4^2 + 6^2} = \sqrt{52}$

b $m_{AB} = \frac{4}{6} = \frac{2}{3}$

c $3y = 2x - 11$

d $M_{AB} = (4, -1)$



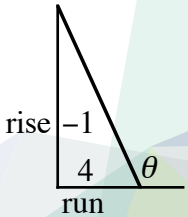
e $y = -3\frac{2}{3}$ **f** $\theta = 33 \cdot 7°$

8 a $AB = \sqrt{1^2 + 4^2} = \sqrt{17}$

b $m_{AB} = -\frac{1}{4}$

c $4y = -x + 11$

d $M_{AB} = (1, 2 \cdot 5)$



e $y = 2\frac{3}{4}$ **f** $\theta = 166 \cdot 0°$

1 Point and Gradient ... find the equation of the line through :

a $A(7,3)$ with gradient 4 **b** $B(8,-9)$ with gradient 10

c $C(4,17)$ with $m=3$ **d** $D(100,-3)$ with gradient -5

e $E(6,-15)$ with gradient $-\frac{2}{3}$ **f** $F(-46,32)$ with $m=-\frac{1}{2}$

2 Parallel ... find the equation of the line through :

a $A(2,9)$ parallel to $4x-3y+11=0$ **b** $B(4,-2)$ // $y=3x-978$

c $C(-2,7)$ // $10y-3x-6=0$ **d** $D(8,-3)$ parallel to $3y+5x=\pi$

e $E(12,0)$ parallel to $6x+55y+1=0$ **f** $F(5,-2)$ // $5x=7y+43$

3 Mixed ...find the equation of the line through :

a $A(8,5)$ with gradient 3 **b** $B(12,-5)$ with gradient -2

c $(-3,5)$ and $(2,35)$ **d** $D(21,-28)$ and $W(24,2)$

e $E(9,2)$ parallel to $3x-10y+1=0$ **f** $F(8,999)$ parallel to $y=101x-2$

g $G(-4,5)$ perp. to $3x-10y+77=0$ **h** $H(8,-3)$ perpendicular to $y=7x+43$

i $I(11,0)$ // to $7y+4x=50$ **j** $J(6,-7)$ $\perp$ $9y-4x-21=0$

k $K(0,77)$ parallel to $33x-2y+56=0$ **l** $L(5,-9)$ parallel to $y=7x-333$

m $M(4,-5)$ perp. to $x-y+1=0$ **n** $N(-1,-2)$ perpendicular to $y=3x+4$

o $(99,1)$ // to $3x+5y+99=0$ **p** $P(3,9)$ $\perp$ $5y+7x-8=0$

q $Q(10,41)$ parallel to $13x-3y+71=0$ **r** $R(30,-21)$ parallel to $y=4x+1109$

Answers:

1 Point and Gradient

a $y=4x-25$ **b** $y=10x-89$

c $y=3x+5$ **d** $y=-5x+497$

e $y=-\frac{2}{3}x-11$ **f** $y=-\frac{1}{2}x+9$

2 parallel

a $4x-3y+19=0$ **b** $y=3x-14$

c $10y-3x-76=0$ **d** $3y+5x=31$

e $6x+55y-72=0$ **f** $5x=7y+39$

3 Mixed

a $y=3x-19$ **b** $y=-2x+19$ **c** $y=6x+23$

d $y=10x-238$ **e** $3x-10y-7=0$ **f** $y=101x+191$

g $10x+3y+25=0$ **h** $7y=-x-13$ **i** $7y+4x=44$

j $4y+9x-26=0$ **k** $33x-2y+154=0$ **l** $y=7x-44$

m $x+y+1=0$ **n** $3y=-x-7$ **o** $3x+5y-302=0$

p $7y-5x-48=0$ **q** $13x-3y-7=0$ **r** $y=4x-141$