SL / Linear functions [17 marks]

1. [Maximum mark: 5]

Point P has coordinates $(-3,\ 2)$, and point Q has coordinates $(15,\ -8)$.
Point M is the midpoint of $[PQ]$.

(a) Find the coordinates of M. [2]

> ### Markscheme
>
> $M(6,\ -3)$ *A1A1*
>
> *[2 marks]*

Line L is perpendicular to $[PQ]$ and passes through M.

(b) Find the gradient of L. [2]

> ### Markscheme
>
> gradient of $[PQ] = -\frac{5}{9}$ *(A1)*
>
> gradient of $L = \frac{9}{5}$ *A1*
>
> *[2 marks]*

(c) Hence, write down the equation of L. [1]

> ### Markscheme
>
> $y + 3 = \frac{9}{5}(x - 6)$ OR $y = \frac{9}{5}x - \frac{69}{5}$ (or equivalent)   *A1*

Note: Do not accept $L = \frac{9}{5}x - \frac{69}{5}$.

[1 mark]

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2.   [Maximum mark: 7]   22N.1.SL.TZ0.1

Let $f(x) = -2x + 3$, for $x \in \mathbb{R}$.

(a)   The graph of a linear function g is parallel to the graph of f and
        passes through the origin. Find an expression for $g(x)$.   [2]

> Markscheme
>
> gradient of g is -2 (may be seen in function, do not accept $-2x + 3$)
> *(A1)*
>
> $g(x) = -2x$ *A1*
>
> *[2 marks]*

(b)   The graph of a linear function h is perpendicular to the graph
        of f and passes through the point $(-1,\ 2)$. Find an
        expression for $h(x)$.   [3]

> Markscheme
>
> gradient is $\frac{1}{2}$ (may be seen in function)   *(A1)*

attempt to substitute **their** gradient and $(-1, \ 2)$ into any form of equation for straight line   *(M1)*

$y - 2 = \frac{1}{2}(x+1)$ OR $2 = \frac{1}{2} \cdot (-1) + c$

$h(x) = \frac{1}{2}(x+1) + 2 \ \left(= \frac{1}{2}x + \frac{5}{2}\right)$ *A1*

[3 marks]

(c)   Find $(g \circ h)(0)$.   [2]

$(g \circ h)(x) = -2\left(\frac{1}{2}x + \frac{5}{2}\right)$ OR $h(0) = \frac{5}{2}$ OR $g\left(\frac{5}{2}\right)$ *(A1)*

$(g \circ h)(0) = -5$ *A1*

[2 marks]

3.   [Maximum mark: 5]   22M.1.SL.TZ1.1

Consider the points $A(-2, \ 20), B(4, \ 6)$ and $C(-14, \ 12)$. The line L passes through the point A and is perpendicular to $[BC]$.

(a)   Find the equation of L.   [3]

$m_{BC} = \frac{12-6}{-14-4} \ \left(= -\frac{1}{3}\right)$ *(A1)*

finding $m_L = \frac{-1}{m_{BC}}$ using their m_{BC} *(M1)*

$m_L = 3$

$y - 20 = 3(x + 2), \ \ y = 3x + 26$ *A1*

Note: Do not accept $L = 3x + 26$

[3 marks]

(b)   The line L passes through the point $(k, \ 2)$.

    Find the value of k.   [2]

Markscheme

substituting $(k, \ 2)$ into their L *(M1)*

$2 - 20 = 3(k + 2)$ OR $2 = 3k + 26$

$k = -8$ *A1*

[2 marks]