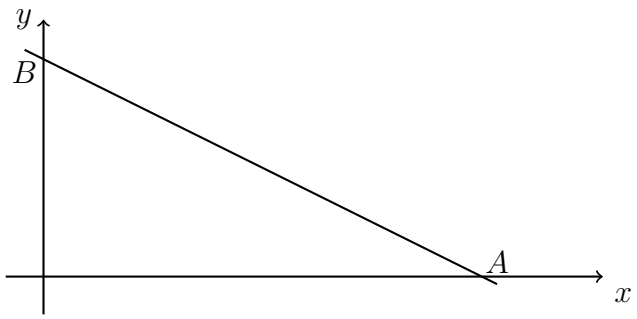
4.11 Exam: Linear equations, function operations, regression

1. [Maximum mark: 9]

The diagram shows the straight line L_1, which intersects the x-axis at $A(k, 0)$ and the y-axis at $B(0, 8)$. The gradient of L_1 is $-\frac{2}{3}$. *Diagram is not to scale*



(a) Find the value of k. [2]

(b) Write down the coordinates of the midpoint M of A and B. [2]

(c) Write down the equation for the line L_1. [2]

(d) The line L_2 is perpendicular to L_1 and passes through M. [3]

Find the equation for the line L_2.

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2. [Maximum mark: 7]

Let $f(x) = 3x + 7$ and $g(x) = 5x$, for $x \in R$.

(a) Write down $g(2)$. [1]

(b) Find $(f \times g)(x)$. [1]

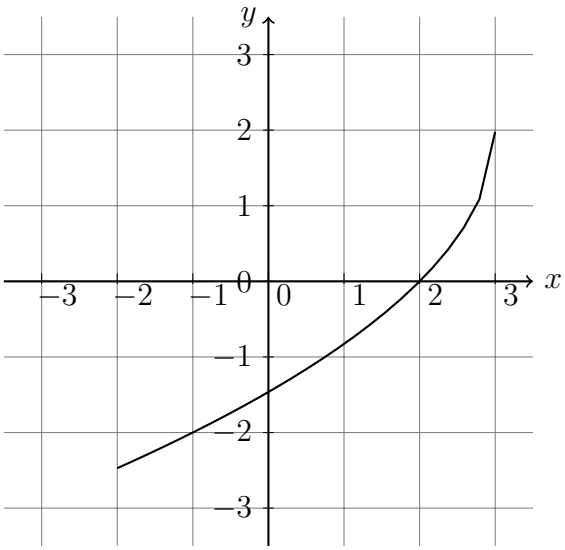
(c) Find $(f \circ g)(x)$. [1]

(d) Write down $g^{-1}(10)$. [2]

(e) Find $f^{-1}(x)$. [2]

3. [Maximum mark: 6]

Early finishers: The diagram below shows the graph of a function f for $-2 \leq x \leq 3$.



(a) Write down the value of $f(2)$. [1]

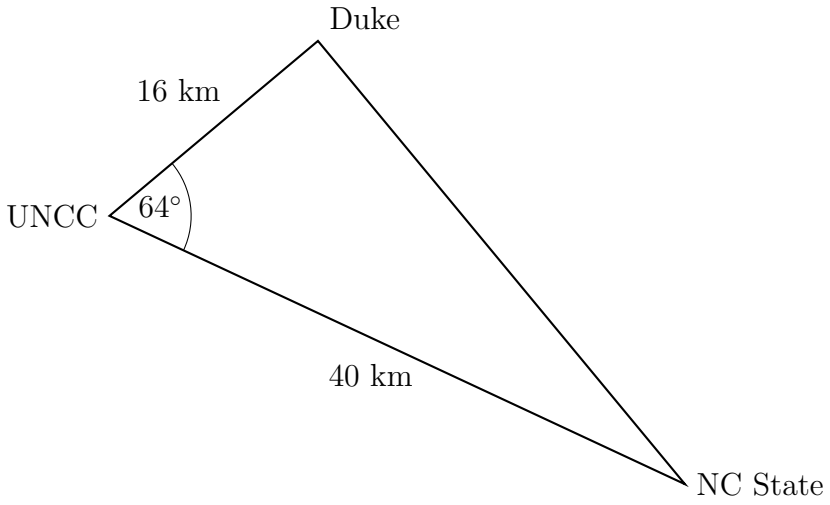
(b) Write down the value of $f^{-1}(-2)$. [2]

(c) Sketch the graph of f^{-1} on the grid. [3]

4. [Maximum mark: 6]

The North Carolina Research Triangle is one of the world's leading regions for high tech businesses and research. The three universities that anchor the area, Duke University, University of North Carolina at Chapel Hill, and North Carolina State University, form a triangle as shown below.

Assume that the distance from UNCC to NC State is 40 km, from UNCC to Duke is 16 km, and that the angle made by Duke, UNCC, and NC State is 64°.



(a) Calculate the distance from Duke to NC State. [3]

(b) Find the area of the triangle formed by the three universities. [3]

Working:

Answers:

(a) .....

(b) .....