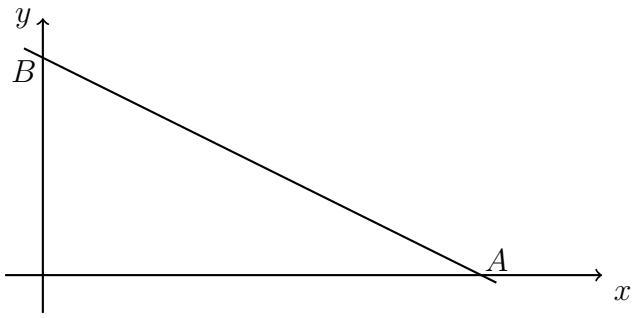
4.11 Exam: Linear equations, function operations, regression

1. [Maximum mark: 6]

The diagram shows the straight line L_1, which intersects the x-axis at $A(k, 0)$ and the y-axis at $B(0, 3)$.

diagram is not to scale



The gradient of L_1 is $-\frac{3}{4}$.

(a) Write down the equation of the line L_1. [1]

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

(c) The line L_2 is perpendicular to L_1 and passes through $(2, 1)$.

i. Write down the gradient of the line L_2. [1]

ii. Hence, write down the equation of L_2. Leave your answer in the form $y - a = m(x - b)$. [2]

2. [Maximum mark: 7]

Let $f(x) = 2x + 8$ and $g(x) = \sqrt{x} - 1$, for $x \geq 0$.

(a) Write down $g(9)$. [1]

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

(c) Find $(g \circ f)(4)$. [1]

(d) Write down $g^{-1}(4)$. [2]

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

Working:

Answers:

(a) .....

(b) .....

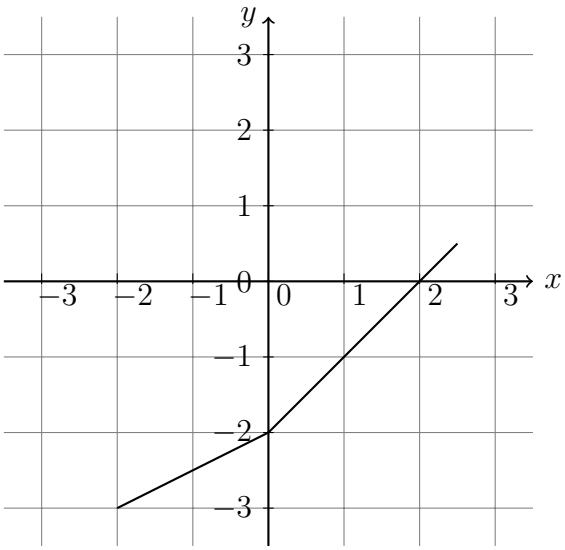
(c) .....

(d) .....

(e) .....

3. [Maximum mark: 6]

Early finishers: The diagram below shows the graph of a function f for $-2 \leq x \leq 2.5$.



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

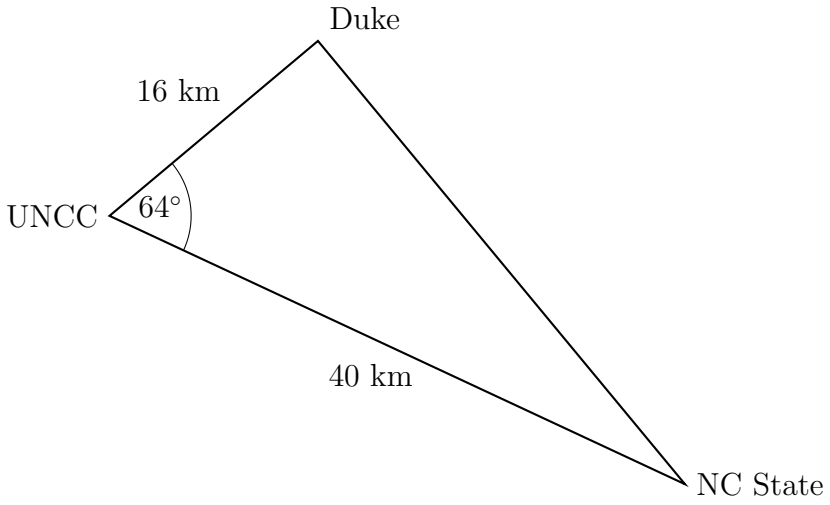
(b) Write down the value of $f^{-1}(-1)$. [2]

(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) .....

5. [Maximum mark: 6]

The following table shows the Diploma score x and university entrance mark y for seven IB Diploma students.

Diploma score (x)	28	30	27	31	32	25	27
University entrance mark (y)	73.9	78.1	70.2	82.2	85.5	62.7	69.4

(a) Find the correlation coefficient. [2]

The relationship can be modelled by the regression line with equation $y = ax + b$.

(b) Write down the value of a and of b [2]

Rita scored a total of 26 in her IB Diploma.

(c) Use your regression line to estimate Rita's university entrance mark. [2]

Working:

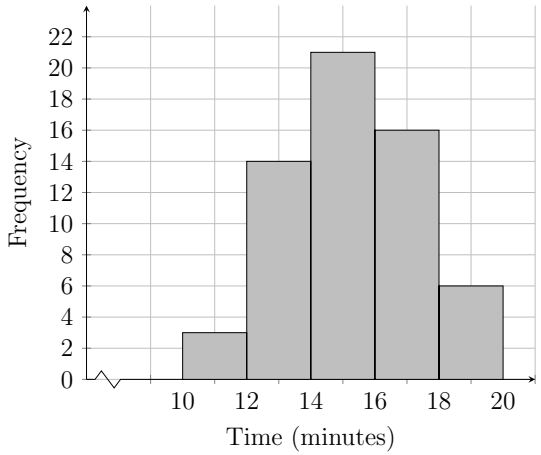
Answers:

(a) .....

(b) .....

(c) .....

6. The chart shows the time t in minutes for 60 marines to complete an obstacle course.



The following is the frequency table for the distribution of t.

Time (t)	$10 \leq t < 12$	$12 \leq t < 14$	$14 \leq t < 16$	$16 \leq t < 18$	$18 \leq t < 20$
Freq	3	14	21	p	6

(a) Write down the value of p. [1]

(b) Write down the modal class. [1]

(c) A marine is selected at random. Find the probability that the marine completed the course in less than 14 minutes. [2]

(d) Write down the mid-interval value for the class $18 \leq t < 20$. [1]

(e) Hence find an estimate for the

i. mean; [2]

ii. standard deviation. [2]

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