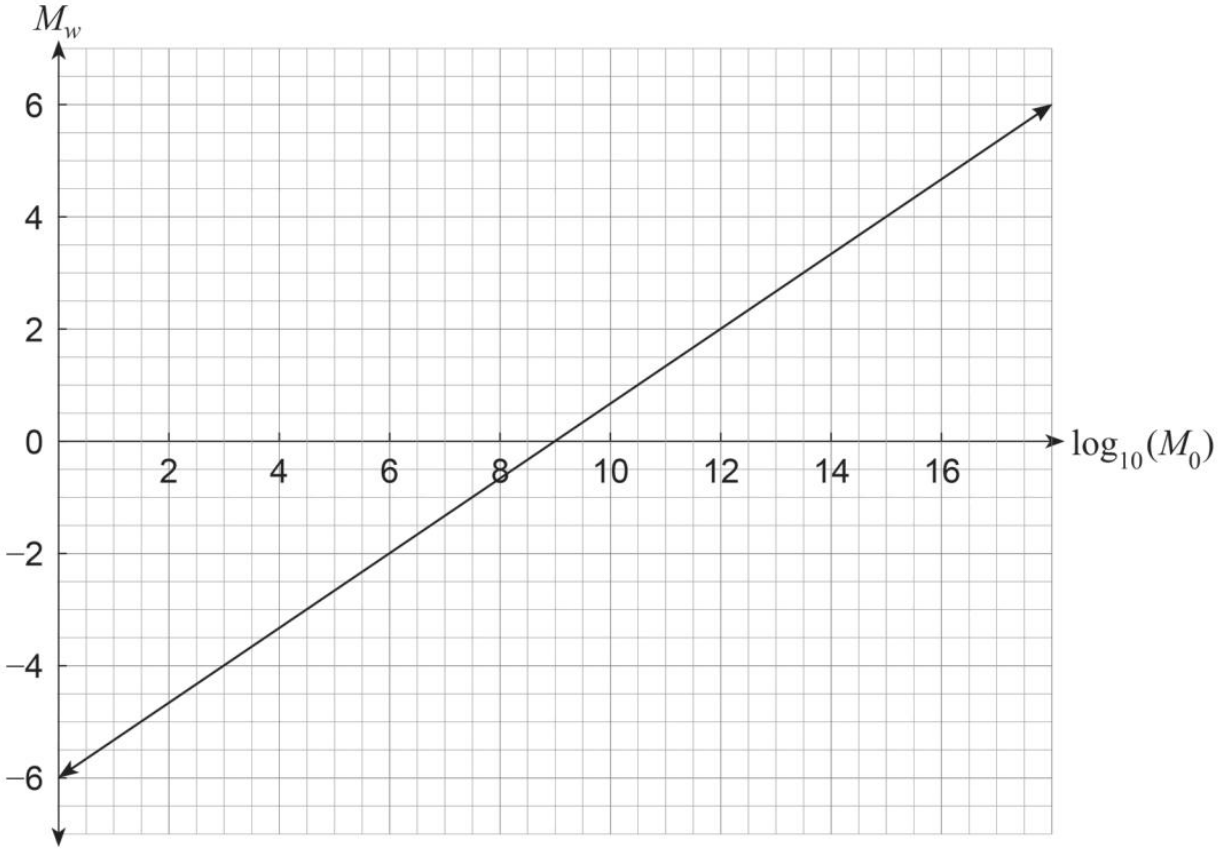
Question 15 **(9 marks)**

Earthquake magnitude can be measured using the moment magnitude scale (M_w), which is related to the seismic moment M_0 of an earthquake. The seismic moment has units of Nm. The graph of M_w versus $\log_{10}(M_0)$ is given below.



(a) Use the graph to approximate the moment magnitude M_w of an earthquake with a seismic moment of 3.16×10^{13} Nm. You must show clearly how you have used the graph.

(2 marks)

A spare grid is provided at the end of this Question/Answer booklet. If you need to use it, cross out this attempt and indicate that you have redrawn it on the spare grid.

(b) The relationship between M_w and M_0 can be expressed in the form

$$M_w = a\log_{10}(M_0) + b.$$

Determine the values of a and b. (2 marks)

(c) Hence, or otherwise, express the relationship between M_w and M_0 in the form

$$M_w = a \log_{10}\left(\frac{M_0}{c}\right).$$

(3 marks)

(d) Determine the seismic moment, M_0, of an earthquake with moment magnitude $M_w = 4$.

(2 marks)