1   **(a)**   Write down the value of 3^0.

(a) .... **[1]**

(b)   Work out the value of the following.

$$\frac{9^3 \times 9^{-\frac{5}{2}}}{9^{\frac{3}{2}}}$$

(b) .... **[3]**

2 (a) Arrange these standard form numbers in order, smallest first.

8.6×10^5 $\quad\quad$ 8.5×10^{-6} $\quad\quad$ 5.6×10^8 $\quad\quad$ 6.8×10^{-5}

(a) _____ _____ _____ _____ **[2]**
$\quad\quad$ *smallest*

(b) The diameter of the Sun is 1.4×10^{11} cm.
The diameter of the Earth is 1.3×10^9 cm.
The diameter of the Sun is K times the diameter of the Earth.

Find K.

(b) _____ **[2]**

3 Find the value of the following.

    (a) $36^{\frac{1}{2}}$

                                                  (a) _____ **[1]**

    (b) $8^{\frac{-1}{3}}$

                                                  (b) _____ **[2]**

4   Use your calculator to work these out.

(a) $4\frac{2}{3} - 1\frac{3}{4}$

Give your answer as a mixed number.

(a) _____ [1]

(b) 8^{-2}
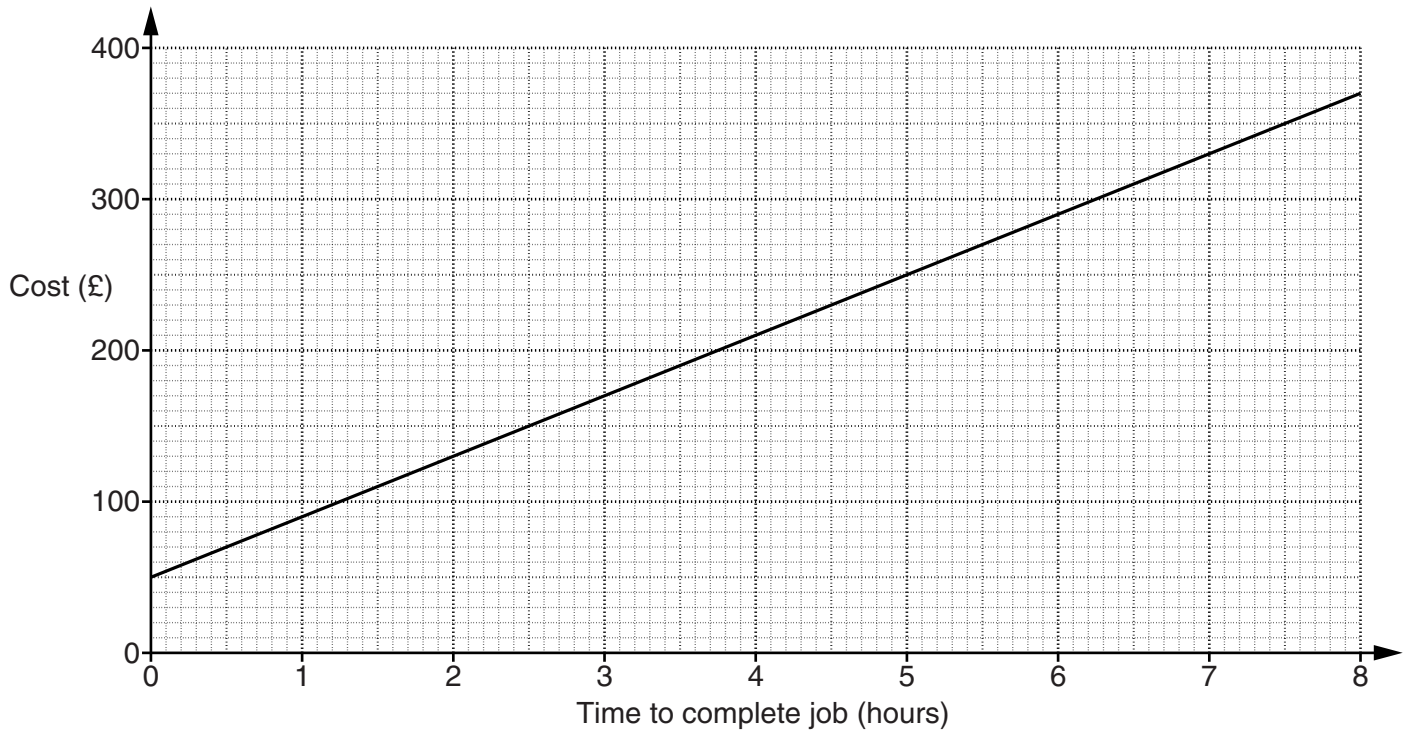Give your answer as a decimal.

(b) _____ [1]

(c) $(\sqrt{5})^6$

(c) _____ [1]

(d) $(9.1 \times 10^4) \times (3.8 \times 10^3)$
Give your answer in standard form.

(d) _____ [2]

5   The graph shows the cost for a plumber from *A1 Plumbing Services* to complete a job.

(a) The cost (£) is made up of a fixed call-out charge and an hourly rate.

Complete these sentences.

(i)   The fixed call-out charge is £ _____ .   **[1]**

(ii) The hourly rate is £ _____ per hour.   **[1]**

(b) A different plumbing company, *Gibbo Plumbers*, has an hourly rate of £55 but no call-out charge.

On the axes above, draw the graph to show the cost for a plumber from *Gibbo Plumbers* to complete a job.   **[2]**

(c) For a job lasting 6 hours, find which company is cheaper and by how much.

(c) _____ is cheaper by £ _____ **[2]**

(d) Use the graphs to find the job time for which *A1 Plumbing Services* and *Gibbo Plumbers* cost the same.

(d) _____ **[1]**

6 **(a)** When 7.2×10^{-10} is written as an ordinary number, how many zeros are there **after** the decimal point?

(a) .... **[1]**

(b) Work out.

$$(1.6 \times 10^4)^2$$

Write your answer in standard form.

(b) .... **[2]**

7 The number of bacteria present in a culture is observed.

This number of bacteria, N, is given by the formula

$$N = 15\,000 \times 2^{-t}$$

where t is the time, in hours, after the observation starts.

(a) How many bacteria are present 3 hours after the observation starts?

(a) .... **[1]**

(b) After how many hours from the start of the observation will the bacteria have disappeared?
That is, after how many hours will the number of bacteria first fall below 1?

(b) .... hours **[2]**

8 (a) Simplify.

$$(3a^3b^4)^2$$

(a) _____ **[3]**

(b) Given that f(x) = 3x − 5, evaluate f(3) − f(1).

(b) _____ **[3]**

(c) Evaluate.

$$125^{-\frac{1}{3}}$$

(c) _____ **[2]**

(d) Rationalise the denominator and simplify.

$$\frac{24}{\sqrt{6}}$$

(d) _____ **[2]**

9 (a) Evaluate.

    (i) 17^0

                                                    (a)(i) _____ **[1]**

    (ii) 4^{-3}

                                                    (ii) _____ **[2]**

(b) The distance, d, in miles to the horizon is given by the formula

$$d = \left(\frac{3h}{2}\right)^{\frac{1}{2}}$$

where h is the height, in feet, of an observer's eyes above sea level.

    (i) How far away is the horizon from a man whose eyes are 6 feet above sea level?

                                                  (b)(i) _____ miles **[2]**

    (ii) From the top of a cliff, Samira can see the horizon 12 miles away.

         Find the height above sea level of Samira's eyes.

                                                  (ii) _____ feet **[3]**

10 Use your calculator to work these out.

   (a) $2\frac{3}{4} \times 1\frac{2}{3}$

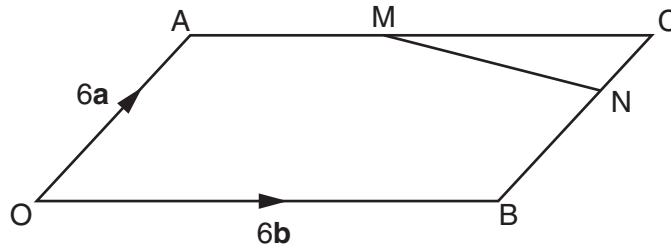   Give your answer as a mixed number in its simplest form.

   (a) _____ **[1]**

   (b) 0.2^{-5}

   (b) _____ **[1]**

11 OACB is a parallelogram.

$\overrightarrow{OA} = 6\mathbf{a}$, $\overrightarrow{OB} = 6\mathbf{b}$, M is the midpoint of AC and CN = $\frac{1}{3}$CB.

Find, in terms of **a** and **b**, the vector t[46][55.2]ch of the following.
Give each answer in its simplest form.

(a) $\overrightarrow{OC}$

(a) _____ **[1]**

(b) $\overrightarrow{AM}$

(b) _____ **[1]**

(c) $\overrightarrow{OM}$

(c) _____**[1]**

(d) $\overrightarrow{MN}$

(d) _____ **[2]**

12 (a Work out.

    (i) the cube of 5

(a)(i) _____ **[1]**

    (ii) $\sqrt{169}$

(ii) _____ **[1]**

(b) (i) Write as a single power of 5.

$$5^6 \times 5^4$$

(b)(i) _____ **[1]**

    (ii) Write as a single power of r.

$$\frac{r^{12}}{r^3}$$

(ii) _____ **[1]**

(c) Find the value of the following.

    (i) 16^0

(c)(i) _____ **[1]**

    (ii) $27^{\frac{2}{3}}$

(ii) _____ **[2]**

13 (a   Write 1.86×10^5 as an ordinary number.

(a) _____ **[1]**

(b) This is a formula used in physics.

$$E = mc^2$$

Calculate E when $m = 5 \times 10^{-4}$ and $c = 3 \times 10^8$.
Give your answer in standard form.

(b) _____ **[2]**

(c) Rearrange the formula

$$E = mc^2$$

to make c the subject.

(c) _____ **[2]**