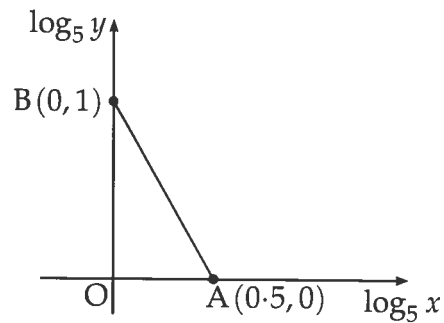① The graph illustrates the law $y = kx^n$.

If the straight line passes through $A(0.5, 0)$ and $B(0,1)$, find the values of $k$ and $n$.

**4**



② Given that $\cos D = \frac{2}{\sqrt{5}}$ and $0 < D < \frac{\pi}{2}$, find the exact values of $\sin D$ and $\cos 2D$.   **3**

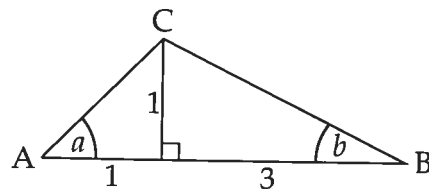③ Express $8\cos x° - 6\sin x°$ in the form $k\cos(x° + a°)$ where $k > 0$ and $0 < a < 360$.   **4**

④ Medical researchers studying the growth of a strain of bacteria observe that the number of bacteria, present after $t$ hours, is given by the formula $N(t) = 40e^{1.5t}$.

(a) State the number of bacteria present at the start of the experiment.   **1**

(b) How many minutes will the bacteria take to double in number?   **4**

⑤ In triangle ABC, show that the exact value of $\sin(a + b)$ is $\dfrac{2}{\sqrt{5}}$.   **4**



⑥ (a) Express $\sin x° - 3\cos x°$ in the form $k\sin(x - a)°$ where $k > 0$ and $0 \le a < 360$. Find the values of $k$ and $a$.   **4**
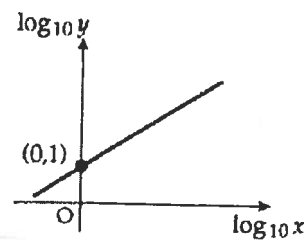
(b) Find the maximum value of $5 + \sin x° - 3\cos x°$ and state a value of $x$ for which this maximum occurs.   **2**

⑦ As shown in the diagram, a set of experimental results gives a straight line graph when $\log_{10} y$ is plotted against $\log_{10} y$. The straight line passes through $(0, 1)$ and has a gradient of 2.

Express $y$ in terms of $x$.   **6**