① Given that $\tan \alpha = \frac{\sqrt{11}}{3}$, $0 < \alpha < \frac{\pi}{2}$, find the exact value of $\sin 2\alpha$.

② Find x if $4 \log_x 6 - 2 \log_x 4 = 1$.

③ For acute angles P and Q, $\sin P = \frac{12}{13}$ and $\sin Q = \frac{3}{5}$.

Show that the exact value of $\sin(P + Q)$ is $\frac{63}{65}$.

④ Before a forest fire was brought under control, the spread of the fire was described by a law of the form $A = A_0 e^{kt}$ where A_0 is the area covered by the fire when it was first detected and A is the area covered by the fire t hours later.

If it takes one and a half hours for the area of the forest fire to double, find the value of the constant k.

⑤ The diagram shows two right-angled triangles ABD and BCD with AB = 7cm, BC = 4cm and CD = 3cm. Angle DBC = $x°$ and angle ABD = $y°$.

Show that the exact value of $\cos(x + y)°$ is $\dfrac{20 - 6\sqrt{6}}{35}$.
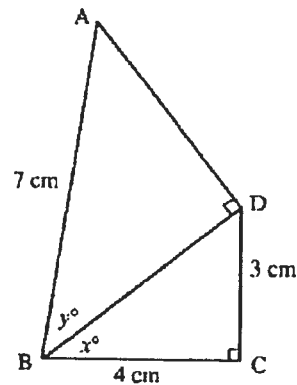
⑥ Find the exact value of $\sin \theta° + \sin(\theta° + 120°) + \cos(\theta° + 150°)$.

⑦ (a) A tractor tyre is inflated to a pressure of 50 units. Twenty-four hours later the pressure has dropped to 10 units.

If the pressure, P, units, after t hours is given by the formula $P_t = P_0 e^{-kt}$, find the value of k, to three decimal places.

(b) The tyre manufacturer advises that serious damage to the tyre will result if it is used when the pressure drops below 30 units.

If the farmer inflates the tyre to 50 units and drives the tractor for four hours, can the tractor be driven further without inflating the tyre and without risking serious damage to the tyre?