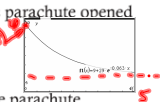


8. Joseph did a parachute jump for charity. After jumping out of the aircraft his velocity at time t seconds after his parachute opened was $v \text{ m s}^{-1}$ where $v = 9 + 29e^{-0.063t}$



a Sketch the graph of v against t .

b What was Joseph's speed at the instant the parachute opened? **38 m/s**

c What was his lowest possible speed if he fell from a very great height? **Just above 9 m/s**

d If he actually landed after 45 seconds what was his speed on landing? **at $t = 45$ $v = 9 + 29e^{-0.063(45)} \approx 10.7$**

e How long did it take him to reach half the speed he had when the parachute opened?

$$\frac{38}{2} = 9 + 29e^{-0.063t}$$

$$19 = 9 + 29e^{-0.063t}$$

$$10 = 29e^{-0.063t}$$

$$\frac{10}{29} = e^{-0.063t}$$

$$\ln\left(\frac{10}{29}\right) = \ln(e^{-0.063t})$$

$$\ln\left(\frac{10}{29}\right) = -0.063t$$

$$\frac{\ln\left(\frac{10}{29}\right)}{-0.063} = t$$

16.9 $\approx t$

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9. (a) Let $\log_c 3 = p$ and $\log_c 5 = q$. Find an expression in terms of p and q for

(i) $\log_c 15$; **$= \log_c (3 \cdot 5) = \log_c 3 + \log_c 5$**

(ii) $\log_c 25$. **$= \log_c (5^2) = 2 \log_c 5$**

(b) Find the value of d if $\log_d 6 = \frac{1}{2}$.

~~$\log_d 6 = \frac{1}{2}$~~

$$6 = d^{\frac{1}{2}}$$

$$(6)^2 = (d^{\frac{1}{2}})^2 \quad \text{or} \quad (6)^2 = (d^{\frac{1}{2}})^2$$

$$36 = d \quad \quad \quad 36 = d$$

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10. Let $p = \log_{10} x$, $q = \log_{10} y$ and $r = \log_{10} z$.

Write the expression $\log_{10} \left(\frac{x}{y^2 \sqrt{z}} \right)$ in terms of p , q and r .

$$\log_{10} X - (\log_{10} y^2 + \log_{10} \sqrt{z})$$

$$\log_{10} X - \log_{10} y^2 - \log_{10} \sqrt{z}$$

$$\log_{10} X - 2 \log_{10} y - \frac{1}{2} \log_{10} z$$

$$p - 2q - \frac{1}{2}r$$

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11. Solve the equation $\log_{27} x = 1 - \log_{27} (x - 0.4)$.

$$\log_{27} x = \log_{27} 27 - \log_{27} (x - 0.4)$$

~~$$\log_{27} x = \log_{27} \left(\frac{27}{x - 0.4} \right)$$~~

$$\frac{x}{1} = \frac{27}{x - 0.4}$$

$$x(x - 0.4) = 27$$

$$x^2 - 0.4x = 27$$

$$x^2 - 0.4x - 27 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{0.4 \pm \sqrt{0.16 - 4(1)(-27)}}{2(1)}$$

$$x = 5.4 \quad x = -5 \text{ reject}$$

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