(d)

$$F = \frac{1}{2}mv^2 \quad [v]$$
$$2 \times F = 2 \times \frac{1}{2}mv^2$$
$$2F = mv^2$$
$$\frac{2F}{m} = \frac{mv^2}{m}$$
$$\frac{2F}{m} = v^2$$
$$\sqrt{\frac{2F}{m}} = \sqrt{v^2}$$
$$\sqrt{\frac{2F}{m}} = v$$

(e)

$$Q = SLd^2 \quad [d]$$
$$\frac{Q}{SL} = \frac{SLd^2}{SL}$$
$$\frac{Q}{SL} = d^2$$
$$\sqrt{\frac{Q}{SL}} = \sqrt{d^2}$$
$$\sqrt{\frac{Q}{SL}} = d$$

(f)

$$v^2 = u^2 + 2as \quad [u]$$
$$v^2 - 2as = u^2 + 2as - 2as$$
$$v^2 - 2as = u^2$$
$$\sqrt{v^2 - 2as} = \sqrt{u^2}$$
$$\sqrt{v^2 - 2as} = u$$

(g)

$$Z = \sqrt{R^2 + \omega^2 L^2} \quad [L]$$
$$Z^2 = \left(\sqrt{R^2 + \omega^2 L^2}\right)^2$$
$$Z^2 = R^2 + \omega^2 L^2$$
$$Z^2 - R^2 = R^2 + \omega^2 L^2 - R^2$$
$$Z^2 - R^2 = \omega^2 L^2$$
$$\frac{Z^2 - R^2}{\omega^2} = \frac{\omega^2 L^2}{\omega^2}$$
$$\frac{Z^2 - R^2}{\omega^2} = L^2$$
$$\sqrt{\frac{Z^2 - R^2}{\omega^2}} = \sqrt{L^2}$$
$$\sqrt{\frac{Z^2 - R^2}{\omega^2}} = L$$

(h)

$$R = \frac{2GM}{c^2} \quad [c]$$
$$c^2 R = \frac{2GM}{c^2} \times c^2$$
$$c^2 R = 2GM$$
$$\frac{c^2 R}{R} = \frac{2GM}{R}$$
$$c^2 = \frac{2GM}{R}$$
$$\sqrt{c^2} = \sqrt{\frac{2GM}{R}}$$
$$c = \sqrt{\frac{2GM}{R}}$$

(i)

$$P = \frac{\pi^2 EI}{L^2} \quad [L]$$
$$L^2 \times P = \frac{\pi^2 EI}{L^2} \times L^2$$
$$L^2 P = \pi^2 EI$$
$$\frac{L^2 P}{P} = \frac{\pi^2 EI}{P}$$
$$L^2 = \frac{\pi^2 EI}{P}$$
$$\sqrt{L^2} = \sqrt{\frac{\pi^2 EI}{P}}$$
$$L = \sqrt{\frac{\pi^2 EI}{P}}$$

The next questions are challenging, take care!

(j)

$$T = 2\pi\sqrt{\frac{r^3}{GM}} \quad [r]$$
$$\frac{T}{2\pi} = \frac{2\pi\sqrt{\frac{r^3}{GM}}}{2\pi}$$
$$\frac{T}{2\pi} = \sqrt{\frac{r^3}{GM}}$$
$$\left(\frac{T}{2\pi}\right)^2 = \left(\sqrt{\frac{r^3}{GM}}\right)^2$$
$$\left(\frac{T}{2\pi}\right)^2 = \frac{r^3}{GM}$$
$$GM \times \left(\frac{T}{2\pi}\right)^2 = \frac{r^3}{GM} \times GM$$
$$GM\left(\frac{T}{2\pi}\right)^2 = r^3$$
$$\sqrt[3]{GM\left(\frac{T}{2\pi}\right)^2} = \sqrt[3]{r^3}$$
$$\sqrt[3]{GM\left(\frac{T}{2\pi}\right)^2} = r$$

(k)

$$F = m\left(g - \frac{v^2}{R}\right) \quad [v]$$
$$\frac{F}{m} = \frac{m\left(g - \frac{v^2}{R}\right)}{m}$$
$$\frac{F}{m} = g - \frac{v^2}{R}$$
$$\frac{F}{m} - g = g - \frac{v^2}{R} - g$$
$$\frac{F}{m} - g = -\frac{v^2}{R}$$
$$g - \frac{F}{m} = \frac{v^2}{R}$$
$$R\left(g - \frac{F}{m}\right) = \frac{v^2}{R} \times R$$
$$R\left(g - \frac{F}{m}\right) = v^2$$
$$\sqrt{R\left(g - \frac{F}{m}\right)} = \sqrt{v^2}$$
$$\sqrt{R\left(g - \frac{F}{m}\right)} = v$$

(l)

$$R = \frac{\pi r^4 (p_2 - p_1)}{8nL} \quad [r]$$
$$8nL \times R = \frac{\pi r^4 (p_2 - p_1)}{8nL} \times 8nL$$
$$8nLR = \pi r^4 (p_2 - p_1)$$
$$\frac{8nLR}{\pi (p_2 - p_1)} = r^4$$
$$\sqrt[4]{\frac{8nLR}{\pi (p_2 - p_1)}} = \sqrt[4]{r^4}$$
$$\sqrt[4]{\frac{8nLR}{\pi (p_2 - p_1)}} = r$$

(m) $A = P(1+i)^n \quad [i]$

$$\frac{A}{P} = \frac{P(1+i)^n}{P}$$

$$\frac{A}{P} = (1+i)^n$$

$$\sqrt[n]{\frac{A}{P}} = \sqrt[n]{(1+i)^n}$$

$$\sqrt[n]{\frac{A}{P}} = 1+i$$

$$\sqrt[n]{\frac{A}{P}} - 1 = 1+i-1$$

$$\sqrt[n]{\frac{A}{P}} - 1 = i$$

Scientific notation

1. Write these numbers in scientific notation

(a) 4 000 000
$= 4\times10^{6}$

(b) 500 000
$= 5\times10^{5}$

(c) 9 300 000 000 000
$= 9.3\times10^{12}$

(d) 345 900
$= 3.459\times10^{5}$

(e) 29 500 000
$= 2.95\times10^{7}$

(f) 354.85
$= 3.5485\times10^{2}$

(g) 5.56
$= 5.56\times10^{0}$

(h) 0.000 04
$= 4\times10^{-5}$

(i) 0.000 000 000 955
$= 9.55\times10^{-10}$

(j) 745
$= 7.45\times10^{2}$

(k) 9
$= 9\times10^{0}$

(l) 0.25
$= 2.5\times10^{-1}$

2. Write these numbers in standard notation

(a) 6×10^{5}
$= 600\,000$

(b) 7.5×10^{10}
$= 75\,000\,000\,000$

(c) 4.2×10^{1}
$= 42$

(d) 1.325×10^{6}
$1\,325\,000$

(e) 3.15×10^{0}
$= 3.15$

(f) 6.1×10^{-5}
$= 0.000\,061$

(g) 9.1×10^{-2}
$= 0.091$

(h) 9.5×10^{0}
$= 9.5$

(i) 5.945×10^{-6}
$= 0.000\,005\,945$

(j) 6.1×10^{5}
$= 610\,000$

(k) 3.125×10^{1}
$= 31.25$

(l) 1.19333×10^{3}
$= 1193.33$

Operations with numbers in scientific notation

1. Perform the operations indicated. (Leave your answers in scientific notation)

(a) $6.02\times10^{23}\times1.6\times10^{-19}$
$= 6.02\times1.6\times10^{23+-19}$
$= 9.696\times10^{4}$

(b) $\left(3.432\times10^{3}\right)\div\left(3\times10^{-12}\right)$
$= (3.432\div3)\times10^{3--12}$
$= 1.144\times10^{15}$

(c) $3.4\times10^{6}+2.125\times10^{8}$
$=3.4\times10^{-2}\times10^{8}+2.125\times10^{8}$
$=0.034\times10^{8}+2.125\times10^{8}$
$=2.159\times10^{8}$

(d) $2.5\times10^{-6}-8.12\times10^{-5}$
$=2.5\times10^{-1}\times10^{-5}-8.12\times10^{-5}$
$=0.25\times10^{-5}-8.12\times10^{-5}$
$=\ ^{-}7.87\times10^{-5}$

2. Perform the operations indicated by changing to scientific notation.

(a) $2\,000\,000\,000\times0.000\,000\,03$
$=2\times10^{9}\times3\times10^{-8}$
$=6\times10^{1}$
or 60

(b) $0.000\,000\,45\div0.000\,000\,000\,31$
$=\left(4.5\times10^{-7}\right)\div\left(3.1\times10^{-10}\right)$
$=\left(4.5\div3.1\right)\times10^{-7-\ ^{-}10}$
$=1.452\times10^{3}$
or 1452

(c) $340\,000\,000\,000\times0.000\,000\,125$
$=3.4\times10^{11}\times1.25\times10^{-7}$
$=4.25\times10^{4}$
or $42\,500$

(d) $0.65\times12\,000\,000\div0.000\,000\,085$
$=6.5\times10^{-1}\ \times\ 1.2\times10^{7}\ \div\ \left(8.5\times10^{-8}\right)$
$=7.8\times10^{6}\ \ \div\ \left(8.5\times10^{-8}\right)$
$=0.9176\times10^{6-\ ^{-}8}$
$=0.9176\times10^{14}$
$=9.176\times10^{13}$

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