MATH 71X

CHAPTER 1 - SELECTED PROBLEMS

SECTION 1.1.4

(13) 243 lb patient ... $\frac{80\text{ mg}}{6\text{ min}}$

175 lb patient ... $\frac{?\text{ mg}}{\text{min}}$

Solution

$$175\text{ lb}\cdot\frac{\frac{80\text{ mg}}{6\text{ min}}}{243\text{ lb}}=\frac{175\cdot 80\text{ mg}}{6\cdot 243\text{ min}}\approx 9.60\frac{\text{mg}}{\text{min}}$$

(15) 165 lb patient ... $\frac{250\text{ mg}}{2\text{ days}}$

210 lb patient ... $\frac{?\text{ mg}}{\text{day}}$

Solution

$$210\text{ lb}\cdot\frac{\frac{250\text{ mg}}{2\text{ days}}}{165\text{ lb}}=\frac{210\cdot 250\text{ mg}}{2\cdot 165\text{ days}}\approx 159.01\frac{\text{mg}}{\text{day}}$$

SECTION 1.2.8

(15) $275\text{ acre}\cdot\text{ft}=?\ \text{m}^3$

We'll use: $\begin{cases}1\text{ acre}=43{,}560\text{ ft}^2\\ 1\text{ ft}=0.3048\text{ m}\end{cases}$

Solution

$$275\text{ acre}\cdot\text{ft}=275\text{ acre}\cdot\text{ft}\cdot\frac{43{,}560\text{ ft}^2}{1\text{ acre}}\cdot\left(\frac{0.3048\text{ m}}{1\text{ ft}}\right)^3=$$

$$\frac{275\cdot 43{,}560\text{ ft}^3\cdot(0.3048)^3\text{ m}^3}{\text{ft}^3}=$$

$$=339{,}208\text{ m}^3$$

(17) 4 gal ... 750 ft^2

$$\frac{4\text{ gal}}{750\text{ ft}^2}=?\ \frac{\text{L}}{\text{m}^2}$$

We'll use: $\begin{cases}1\text{ gal}=3.7854\text{ L}\\ 1\text{ ft}=0.3048\text{ m}\end{cases}$

Solution

$$\frac{4\text{ gal}}{750\text{ ft}^2}=\frac{4\text{ gal}}{750\text{ ft}^2}\cdot\frac{3.7854\text{ L}}{1\text{ gal}}\cdot\left(\frac{1\text{ ft}}{0.3048\text{ m}}\right)^2$$

$$=\frac{4(3.7854)\text{ L}\cdot\text{ft}^2}{750\,(0.3048)^2\,\text{ft}^2\cdot\text{m}^2}$$

$$=0.2173\frac{\text{L}}{\text{m}^2}$$

(23) $\frac{5\text{ g med}}{260\text{ mL sol}}$ at $\frac{6\text{ mg med}}{\text{min}}$

Find $\#\ \frac{\text{mL sol}}{\text{h}}$

Solution

$$\frac{6\text{ mg med}}{\text{min}}\cdot\frac{260\text{ mL sol}}{5\text{ g med}}\cdot\frac{1\text{ g}}{1000\text{ mg}}\cdot\frac{60\text{ min}}{1\text{ h}}=$$

$$=\frac{6\cdot 260\cdot 60\text{ mL sol}}{5\cdot 1000\text{ h}}=18.72\frac{\text{mL}}{\text{h}}$$

SECTION 1.3.9

(31) $\frac{20\text{ mL sol}}{\text{h}}$ with $\frac{45000\text{ u med}}{300\text{ mL sol}}$

Find $\#\ \frac{\text{u}}{\text{h}}$

Solution

$$\frac{45000\text{ u}}{300\text{ mL}}\cdot\frac{20\text{ mL}}{\text{h}}=\frac{45000\cdot 20\text{ u}}{300\text{ h}}$$

$$=3000\frac{\text{u}}{\text{h}}$$

(33) 1200 ft^2 ... \$2200

200 m^2 ... ? \$

We'll use 1 ft = 0.3048 m

Solution

$$200\text{ m}^2\cdot\left(\frac{1\text{ ft}}{0.3048\text{ m}}\right)^2\cdot\frac{2200\,\$}{1200\text{ ft}^2}=$$

$$= \frac{20\cancel{0} \cdot 2200\ \cancel{m^2}\ \cancel{ft^2}\ \$}{(0.3048)^2 \cdot 120\cancel{0}\ \cancel{m^2}\ \cancel{ft^2}}$$

$$= 3946.77\ \$$$

SECTION 1.4.6

(9) $5e^{4t} - \frac{11}{3}e^{4t} =$

$= e^{4t}\left(\frac{5}{1} - \frac{11}{3}\right) = e^{4t}\left(\frac{15-11}{3}\right) =$

$= \frac{4}{3}e^{4t}$

(49) $\frac{32a^2b^6c + 8a^2b^6d}{24ab^2c - 12ab^2d} =$

$= \frac{8a^2b^6(4c+d)}{12ab^2(2c-d)} = \frac{2a(4c+d)}{3b(2c-d)}$

(55) $\frac{7}{2}\sqrt{44} - \frac{4}{3}\sqrt{99} =$

$= \frac{7}{2}\sqrt{4 \cdot 11} - \frac{4}{3}\sqrt{9 \cdot 11}$

$= \frac{7}{2} \cdot 2\sqrt{11} - \frac{4}{3} \cdot 3\sqrt{11} = 7\sqrt{11} - 4\sqrt{11}$

$= 3\sqrt{11}$

(65) $\sqrt{\frac{3x^{-1}y\,z^4}{75x^5y^{-7}z^{-2}}} = \sqrt{\frac{y^8z^6}{25x^6}} = \frac{y^4z^3}{5x^3}$

(71) 25 g salt ... 4 gal water

? g salt ... 2.5 L water

We'll use 1 gal = 3.7854 L

Solution

$2.5\ \cancel{L} \cdot \frac{1\ \cancel{gal}}{3.7854\ \cancel{L}} \cdot \frac{25\ g}{4\ \cancel{gal}} =$

$= \frac{2.5 \cdot 25\ g}{3.7854 \cdot 4} = 4.1277\ g \approx 4.1\ g$

SECTION 1.5.8

(9) $W = \frac{1}{2}m(V_2^2 - V_1^2)$, $V_2 = ?$

$2W = m(V_2^2 - V_1^2)$

$\frac{2W}{m} = V_2^2 - V_1^2$

$V_2^2 = V_1^2 + \frac{2W}{m}$

$V_2 = \pm\sqrt{V_1^2 + \frac{2W}{m}} \Rightarrow V_2 = \sqrt{V_1^2 + \frac{2W}{m}}$

(19) 2765.29 $ = sales + sales tax

sales tax rate = 9%

let x: sales

then 9% x = 0.09x = sales tax

then $x + 0.09x = 2765.29$

$x(1 + 0.09) = 2765.29$

$x = \frac{2765.29}{1.09} = 2536.96\ \$$

(25) let P = gas pressure

V = volume

then $P = \frac{k}{V}$, where k - constant

when V = 20 mL, P = 83 kPa

$83\ kPa = \frac{k}{20\ mL} \Rightarrow$

$k = 83 \cdot 20\ kPa \cdot mL$

$k = 1660\ kPa \cdot mL$

then $P = \frac{1660}{V}$

find P if V = 13 mL

$P = \frac{1660\ kPa \cdot \cancel{mL}}{13\ \cancel{mL}} = 127.6923\ kPa$

$P \approx 127.7\ kPa$

(37) $\frac{8x^2-24xz}{16x^2-32xy} = \frac{8x(x-3z)}{16x(x-2y)}$

$= \frac{x-3z}{2(x-2y)}$

(39) $\sqrt{\frac{r^4s^8t}{q^2(s^4t)^3}} = \sqrt{\frac{r^4s^8t}{q^2s^{12}t^3}}$

$= \sqrt{\frac{r^4}{q^2s^4t^2}} = \frac{r^2}{qs^2t}$

SECTION 1.6.4

(23) $-2|5-2z|+3 \geq -27$

$-2|5-2z| \geq -30$ $\quad / \div(-2)$

$|5-2z| \leq 15$

$-15 \leq 5-2z \leq 15$

$-5 \quad -5 \quad -5$

$-20 \leq -2z \leq 10$ $\quad / \div(-2)$

$10 \geq z \geq -5$

$-5 \leq z \leq 10$

$z \in [-5, 10]$

(31) $|\mu - \bar{x}| < E$

$\bar{x} = 9.24 \times 10^{-3}$, $E = 1.67 \times 10^{-5}$

$|\mu - 9.24 \times 10^{-3}| < 1.67 \times 10^{-5}$

$-1.67 \times 10^{-5} < \mu - 9.24 \times 10^{-3} < 1.67 \times 10^{-5}$

$9.24 \times 10^{-3} - 1.67 \times 10^{-5} < \mu < 1.67 \times 10^{-5} + 9.24 \times 10^{-3}$

$10^{-3}(9.24 - 1.67 \times 10^{-2}) < \mu < 10^{-3}(1.67 \times 10^{-2} + 9.24)$

$10^{-3}(9.24 - 0.0167) < \mu < 10^{-3}(0.0167 + 9.24)$

$9.2233 \times 10^{-3} < \mu < 9.2567 \times 10^{-3}$

$0.0092233 < \mu < 0.0092567$

(35) 172 lb

600 mg med. in 500 mL solution

$\frac{20\ mL}{h}$

Find # $\frac{\mu g}{kg \cdot min}$

Solution

$\frac{\frac{600\ mg}{500\ mL}}{172\ lb} \cdot \frac{20\ mL}{h} \cdot \frac{1000\ \mu g}{1\ mg} \cdot \frac{2.2046\ lb}{1\ kg} \cdot \frac{1\ h}{60\ min}$

$= \frac{600 \cdot 20 \cdot 1000 \cdot 2.2046\ \mu g}{500 \cdot 172 \cdot 60\ min \cdot kg}$

$= 5.126976 \frac{\mu g}{min \cdot kg} \approx 5.127 \frac{\mu g}{kg \cdot min}$

(41) $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$, $n =$

$\frac{E}{z_{\alpha/2}} = \sqrt{\frac{\hat{p}\hat{q}}{n}}$ $\quad / ^2$

$\frac{E^2}{z_{\alpha/2}^2} = \frac{\hat{p}\hat{q}}{n} \Rightarrow$

$nE^2 = z_{\alpha/2}^2 \hat{p}\hat{q}$

$n = \frac{z_{\alpha/2}^2 \hat{p}\hat{q}}{E^2}$

SECTION 1.7.7

(47) $$\frac{a^2b^{-3}c}{(a^{-1}b^{-2}c^2)^3} = \frac{a^2b^{-3}c}{a^{-3}b^{-6}c^6}$$

$$= a^{2-(-3)}\, b^{-3-(-6)}\, c^{1-6} = a^5 b^3 c^{-5}$$

$$= \frac{a^5b^3}{c^5}$$

(55) $$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$$, $\bar{x} = 1.87$, $\mu = 1.30$, $s = 0.590$, $n = 110$

$$t = \frac{1.87 - 1.30}{\frac{0.590}{\sqrt{110}}} = 10.13256006 \approx 10.1$$

(51) $$E = \frac{Q}{4\pi\varepsilon r^2}$$, $\varepsilon = ?$

$$E \cdot 4\pi\varepsilon r^2 = Q$$

$$\varepsilon = \frac{Q}{4\pi E r^2}$$