A0118268 85:10

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Set: Saturday morning

Sig:

①

a) $\log_3 81x = 3$

$81x = 3^3$

$81x = 27$

$\boxed{x = 1/3}$ ✓

b) $\log_4\left(\frac{x-1}{3}\right) = 2$

$\frac{x-1}{3} = 4^2$

$\frac{x-1}{3} = 16$

$x - 1 = 48 \Rightarrow \boxed{x = 49}$ ✓

c) $\log_6(x+1) + \log_6 3 = \log_6 x + \log_6 9$

$\log_6^{(x+1)} + \log_6^3 = \log_6^x + \log_6 3^2$

$\log_6^{(x+1)} + \log_6 3 = \log_6^x + 2\log_6^3$

$\log_6^{(x+1)} - \log_6^x = 2\log_6^3 - \log_6^3$

$\log_6 \frac{x+1}{x} = \log_6^3$

$\frac{x+1}{x} = 3 \Rightarrow x+1 = 3x \Rightarrow x - 3x = -1 \Rightarrow -2x = -1 \Rightarrow$

  ↳ multiply by x

$\Rightarrow \boxed{x = \frac{1}{2}}$ ✓

d) $\log_{6^2} 16 + \log_6^4 = \log_6^{2x}$

$\log_{6^2} 2^4 + \log_6 2^2 = \log_6^{2x}$

$\frac{4}{2}\log_6 2 + 2\log_6 2 = \log_6^{2x}$

$2\log_6 2 + 2\log_6 2 = \log_6^{2x} \Rightarrow$

$\Rightarrow 4\log_6 2 = \log_6^{2x}$

$\log_6^{2x} = \log_6 2^4$

$2x = 2^4$

$2x = 16 = 16/2 = \boxed{x = 8}$ ✓

e) $\log_2 4x = \log_4 (64x^4) - 6$

$\log_2 (4) + \log_2 x = \log_{2^2}(64x^4) - 6$

$\log_2 (2^2) + \log_2 x = \frac{1}{2}\log_2 (64x^4) - 6$

$\log_2 (2^2) + \log_2 x = \frac{1}{2}(\log_2 (64) + \log_2 (x^4)) - 6$

$2 + \log_2 x = \frac{1}{2}(\log_2 (2^6) + \log_2 (x^4)) - 6$

$2 + \log_2 x = \frac{1}{2}(6 \log_2 2 + \log_2 x^4) - 6$

$2 + \log_2 x = \frac{1}{2}(6 + \log_2 x^4) - 6$

$2 + \log_2 x = 3 + \frac{1}{2}\log_2 x^4 - 6 \; : \; \frac{1}{2} \times 4 \log_2 x = 2 \log_2 x \; ; \; 3 - 6 = -3$

$2 + \log_2 x = -3 + 2\log_2 x$

$\log_2 x - 2\log_2 x = -3 - 2$

$-\log_2 x = -5$

$\log_2 x = 5$

$\boxed{x = 2^5 = 32 \; : \; x = 32}$

② $x = \log_6 8 \quad y = \log_6 3$

a) $\log_6 \dfrac{192}{9} = \dfrac{192^{\cancel{9}}}{9} / 3 = \dfrac{64}{3}$: divide both by 3.

$\log_6 \dfrac{64}{3} = \log_6 64 - \log_6 3 \Rightarrow$

$\Rightarrow \log_6 8^2 - \log_6 3 = 2\log_6 8 - \log_6 3 \Rightarrow$

$\Rightarrow \boxed{2X - y}$

✓

b) $\log_{96} 64/36 = \dfrac{\log_6 \dfrac{64}{36}}{\log_6 96} \Rightarrow$

$\Rightarrow \dfrac{\log_6 64 - (\log_6 3 + \log_6 6)}{\log_6 9 + \log_6 6} = \dfrac{\log_6 8^2 - \log_6 3^3 - 1}{\log_6 3^2 + 1} \Rightarrow$

~~$2\log_6 8 \ \log_6 6$~~

$\Rightarrow \dfrac{2\log_6 8 - \log_6 3 - 1}{2\log_6 3 + 1} \boxed{= \dfrac{2X - Y - 1}{2y + 1}}$

✓

③ $S(t) = [1 + 4\cos(5t)]\cos(10t)$

ⓐ ~~cos~~ $S(t) = \cos(10t) + 4\cos(10t)\cos(5t)$

using Trigonometric Iden: $\cos(x)\cos(y) = \frac{1}{2}[\cos(x-y) + \cos(x+y)]$

$S(t) = \cos(10t) + 4 \times \frac{1}{2}[\cos(10t-5t) + \cos(10t+5t)]$

$S(t) = \cos(10t) + 2\cos 5t + 2\cos 15t$

using Trigonometric Iden: $\cos\alpha = \sin(\pi/2 - \alpha)$

$S(t) = \underset{sin}{\cancel{\cos}}(\pi/2 - 10t) + 2\sin(\pi/2 - 5t) + 2\sin(\pi/2 - 15t)$ ✓

ⓑ ~~$\sin(\pi/2 - 10t)$~~

$y = \sin(\pi/2 - 10t)$ $y = 2\sin(\pi/2 - 5t)$ $y = 2\sin(\pi/2 - 15t)$

$A = 1$ $A = 2$ $A = 2$

$f = \boxed{-10}/2\pi$ ✗ $f = \pm 5/2\pi$ $f = +15/2\pi$

$\theta = \pi/2$ $\theta = \pi/2$ $\theta = \pi/2$

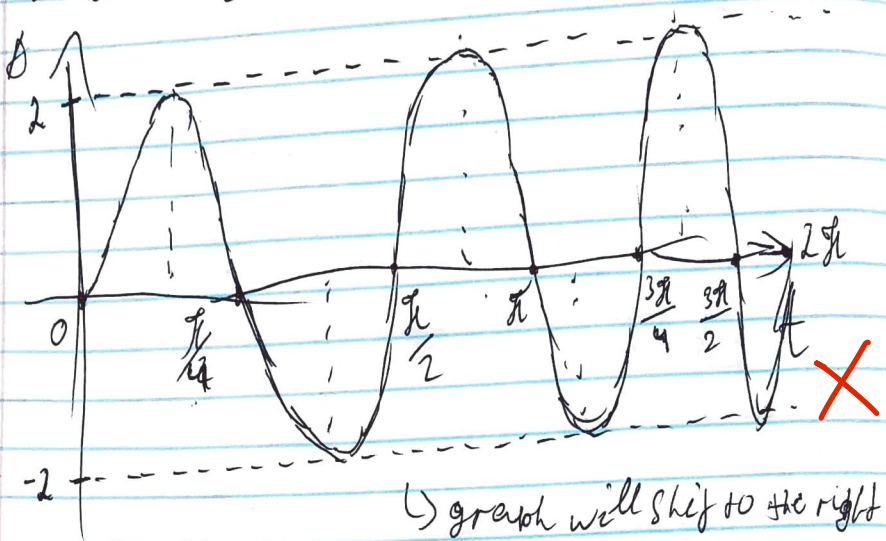$\boxed{\pi = 2\pi f = f = \pi/2\pi = \frac{1}{\cancel{2\pi}}}$ — formula for frequency.

— |
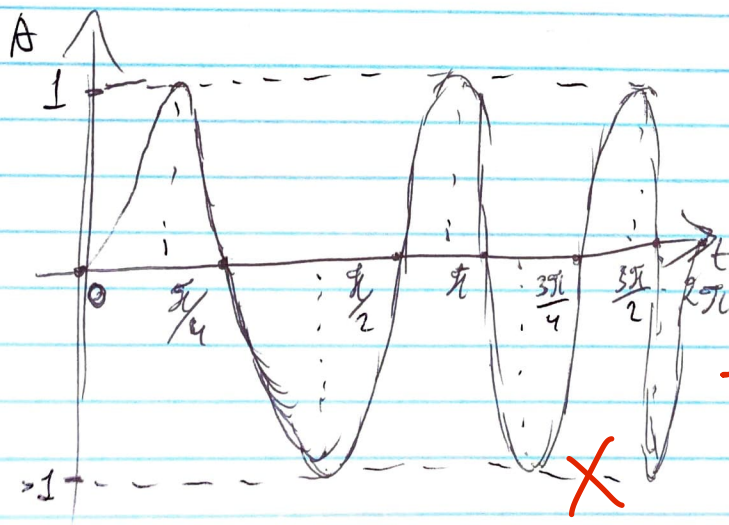
ⓒ $y = \sin(\pi/2 - 10t)$

graph will shift to the right side
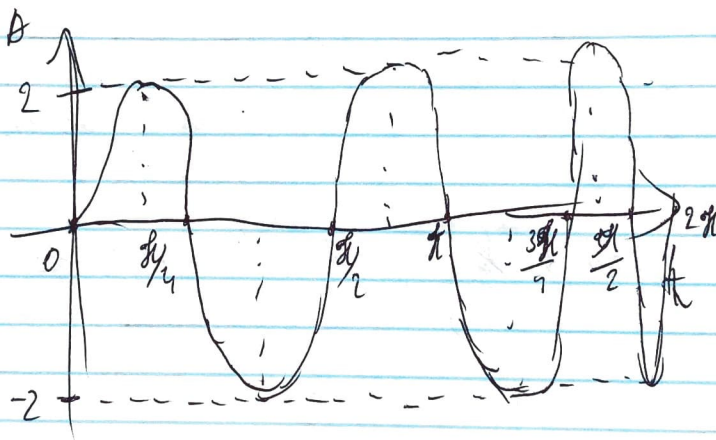ay $\frac{\pi/2}{10}$

$t \times f = 2\pi \times \frac{10}{2\pi} = 10$ cycles

— |
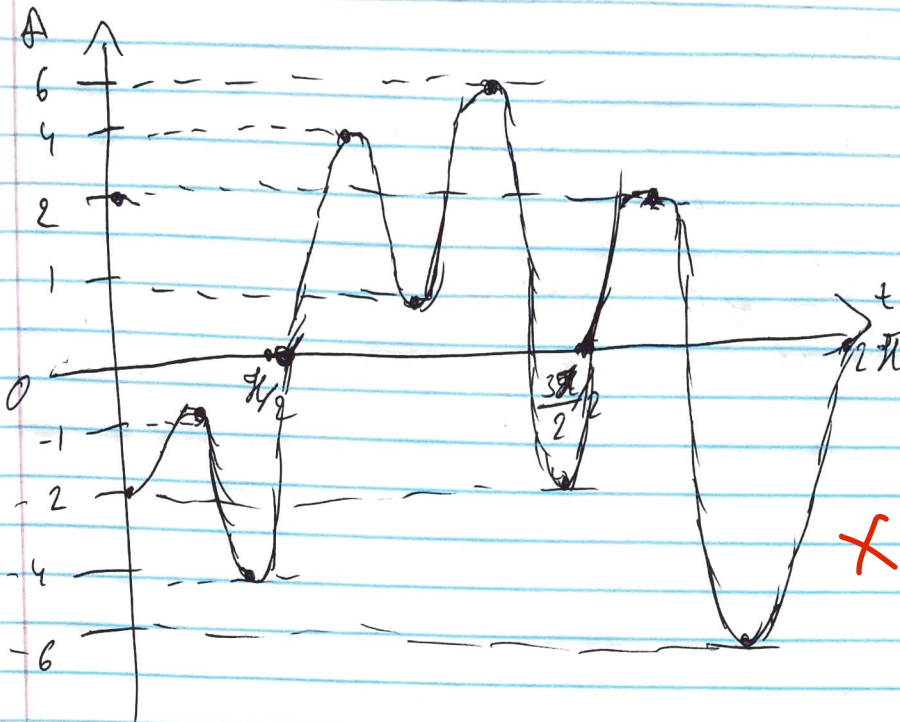
$y = 2\sin\left(\frac{\pi}{2} - 5t\right)$

→ graph will shift to the right side by $\frac{\pi/2}{5}$

$y = 2\sin\left(\frac{\pi}{2} - 15t\right)$

→ graph will shift to right side by $\frac{\pi/2}{15}$

(a) $y = \sin\left(\frac{x}{2} - 10t\right) + 2\sin\left(\frac{x}{2} - 5t\right) + 2\sin\left(\frac{x}{2} - 15t\right)$

−2

(4) propagation time $= \dfrac{Distance}{propagation\,speed} \implies$

$\implies \dfrac{1200}{2 \times 10^8\,m/s} = 6 \times 10^{-5}$

message size $= (1920 \times 1080) \times 24\,fps \times (8\,bits \times 3\,bits/pixel) \times 120\,mins$

$\times 60\,S/min = 8.6 \times 10^{12}\,bits.$

Transmition rate $= \boxed{TE} = 1 \times 10^{12}\,bps$ ✗ GbE: $1 \times 10^9\,bps$

transmition time $=$ message size/transmition rate $= \dfrac{8.6 \times 10^{12}}{1 \times 10^{12}} = 8.6$ S

latency $=$ propagation time $+$ transmition time $= 6 \times 10^{-5} + 8.6 \implies$

$\implies 8.60006(S)$ ✗

~~latency = 34.002 + 8.6 =~~
$$\text{~~latency = } \frac{}{\text{speed}} + 8.6 =$$

$8.6 \times 4 = 34.4$?

$\text{latency} = \frac{34.4}{\text{speed}} + 8.6 = 8.60066$

X

$\text{Speed} = \frac{34.4}{0.00006} \approx 573333 \, m/s$

missing T trans·drone

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