1 (circled, top right)

1. $$P(t) = \frac{10^5 P(0)}{P(0) + (10^5 - P(0))e^{-.01t}}$$

KNOW $P(0) = 0$, SO

$$P(t) = \frac{10^5 \cdot 0}{\cdots\cdots} = \underline{\underline{0}}$$

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2. $$\lim_{n\to\infty} \frac{n}{n+1} = \lim_{n\to\infty} \frac{1}{1+\frac{1}{n}} = \frac{1}{1+0} = \underline{\underline{1}}$$

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3. $\sin \frac{n\pi}{2} = 0$ IF n EVEN, ALTERNATES ± 1 IF n ODD

$\rightarrow$ LIM DOES NOT EXIST

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4. $$.\overline{2} = 2\cdot\frac{1}{10} + 2\cdot\frac{1}{10^2} + 2\cdot\frac{1}{10^3} + 2\cdot\frac{1}{10^4} + \cdots$$

$$= \frac{2}{10}\left(1 + \frac{1}{10} + \frac{1}{10^2} + \frac{1}{10^3} + \cdots\right)$$

$$= \frac{1}{5}\left(\frac{1}{1-1/10}\right) = \frac{1}{5}\cdot\frac{10}{9} = \underline{\underline{\frac{2}{9}}}$$

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5. $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \cdots$ IS THE HARMONIC SERIES, WHICH WE SHOWED DOESN'T CONVERGE

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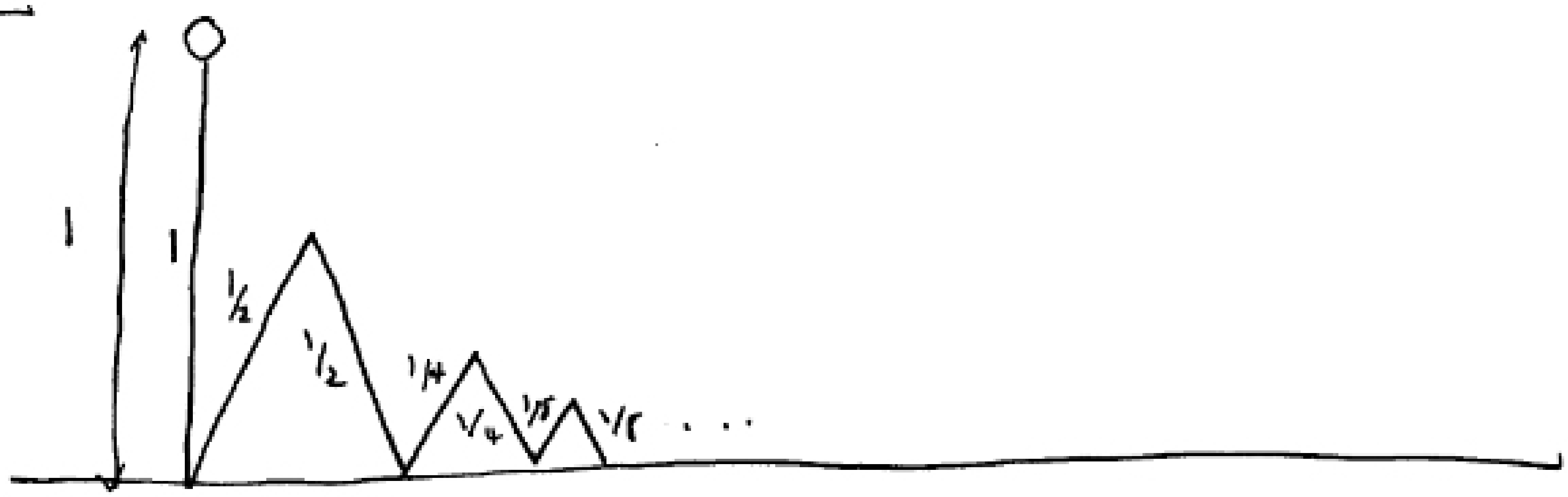
6. $$\sum_{n=0}^{\infty}\left(\frac{1}{2^n} - \frac{1}{3^n}\right) = \sum_{n=0}^{\infty}\frac{1}{2^n} - \sum_{n=0}^{\infty}\frac{1}{3^n}$$

$$= \sum_{n=0}^{\infty}\left(\frac{1}{2}\right)^n - \sum_{n=0}^{\infty}\left(\frac{1}{3}\right)^n$$

$$= \frac{1}{1-1/2} - \frac{1}{1-1/3} = \frac{2}{2-1} - \frac{3}{3-1}$$

$$= 2 - \frac{3}{2} = \underline{\underline{\frac{1}{2}}}$$

#15:



TOTAL DISTANCE TRAVELLED =

$$1 + 2\cdot\frac{1}{2} + 2\cdot\frac{1}{4} + 2\cdot\frac{1}{8} + \cdots$$

$$= 1 + \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} \cdots\right) = 1 + \frac{1}{1-1/2} = 1 + 2 = \underline{3} \text{ m.}$$

7) Straightforward use of error bounds from the Integral Test:

$$|S - S_{10}| = |R_{10}| \leq \int_{10}^{\infty} \frac{1}{x^3}\,dx = \lim_{t \to \infty} \left[-\frac{1}{2x^2} \right]_{10}^{t}$$

$\uparrow$ TRUE SUM

$$= \boxed{.005}$$

8) $\lim_{n \to \infty} \dfrac{\sin\left(\frac{1}{\sqrt{n}}\right)}{\frac{1}{\sqrt{n}}} = 1$, so by the Limit Comparison Test, $\sum \sin\left(\frac{1}{\sqrt{n}}\right)$ has same behavior as $\sum \frac{1}{\sqrt{n}}$.

But $\sum \frac{1}{\sqrt{n}}$ is a divergent p-series ($p = \frac{1}{2} < 1$),

So $\sum_{n=1}^{\infty} \sin\left(\frac{1}{\sqrt{n}}\right)$ diverges by L.C.T. w/ $\sum \frac{1}{\sqrt{n}}$

9) I) If $\sum a_n$ converges, then $a_n \to 0$. TRUE

II) If $\sum b_n$ converges, $b_n > 0$, then $\sum \frac{b_n}{n^2}$ converges. TRUE ($\frac{b_n}{n^2} \leq b_n$, Comp. Test)

III) If $\sum a_n$ converges and $a_n = f(n)$, then $\lim_{x \to \infty} f(x) = 0$. FALSE (This is tricky. Consider the function $\sin(x\pi) = f(x)$. Then $f(n) = \sin(n\pi) = 0$, so $f(n) \to 0$ as $n \to \infty$, but $f(x)$ oscillates between ± 1 as $x \to \infty$).