TOA 2019

78) $f(x) = x \qquad g(x) = \ln x$

Prove $f(x) < g(x)$ for $x \in (0, \pi/2)$

$h = g - f$

$h(0) = 0$

$h = \ln x - x$

$h' = \frac{1}{x} - 1 \geq 0$

$\therefore \quad h > 0 \text{ for } x \in (0, \pi/2)$

$\therefore \quad g - f > 0 \Rightarrow g > f$

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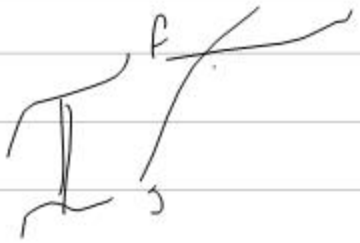


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93) Min $(0,2)$ $(4,0)$ $y = ax^4 + bx^3 + cx^2 + dx + e$

Max $(2,4)$

$y(0) = 0 = e$

$y' = 4ax^3 + 3bx^2 + 2cx + d$

$y'(0) = d = 0$

$256a + 48b + 8c = 0$

$\rightarrow 32a + 12b + 4c = 0$

$32a + 6b + c = 0$

$-8a - 3b - c = 0$

$24a + 3b = 0$

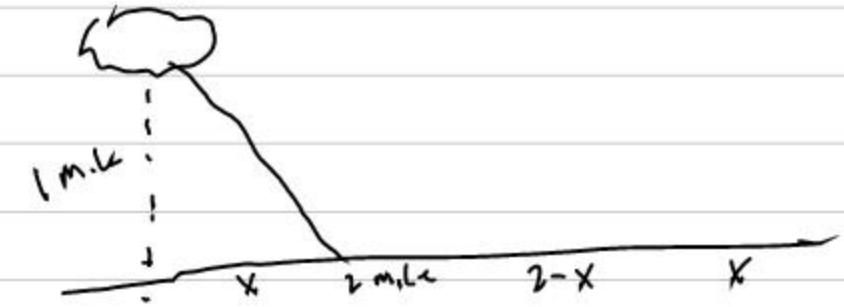
$8a + b = 0$

$256a + 64b + 16c = 0$

$16a + 4b + c = 0$

$-8a - 3b - c = 0$

$8a + b = 0$




1.4 x energy to fly over water as land

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$$E(x) = 1.4\sqrt{1+x^2} + 2 - x \qquad x \in [0, 2]$$

$$E'(x) = \frac{1.4(2x)}{2\sqrt{1+x^2}} - 1 = 0$$

$$\frac{1.4x}{\sqrt{1+x^2}} = 1$$

$$1.4x = \sqrt{1+x^2}$$

$$\frac{49}{25}x^2 = 1 + x^2$$

$$\frac{24}{25}x^2 = 1$$

$$x^2 = \frac{25}{24}$$

$$x = \frac{5}{2\sqrt{6}}$$

$$E\left(\frac{5}{2\sqrt{6}}\right) = 2.9798$$

$$E(0) = 3.4$$

$$E(1) = 3.13$$