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- Midterm questions
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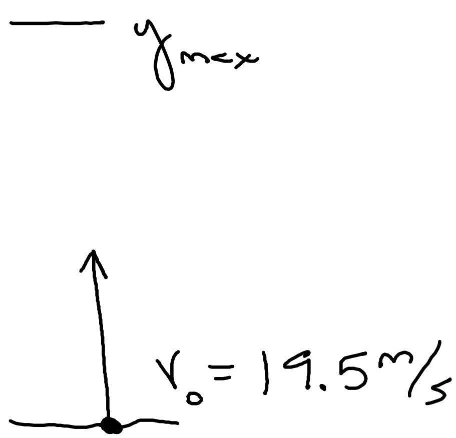
- Introduction to Newtonian Dynamics

Midterm Questions



$$y = \frac{\overset{0}{\cancel{v}}{}^{2} - v_0^2}{2a}$$

$$y = \frac{-(19.5\,m/s)^2}{2(-9.8\,m/s^2)}$$

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$$f(x) = 4\sec^2(3\pi t - 3) = 4\left[\sec(3\pi t - 3)\right]^2$$

$$f'(x) = 8\left[\sec(3\pi t - 3)\right]^1 \sec(3\pi t - 3)\tan(3\pi t - 3)\,3\pi$$

$$= 24\pi \sec^2(3\pi t - 3)\tan(3\pi t - 3)$$

Homework Q & A

21. E
22. E
23. int
24. C
25. C
26. int
27. int
28. int

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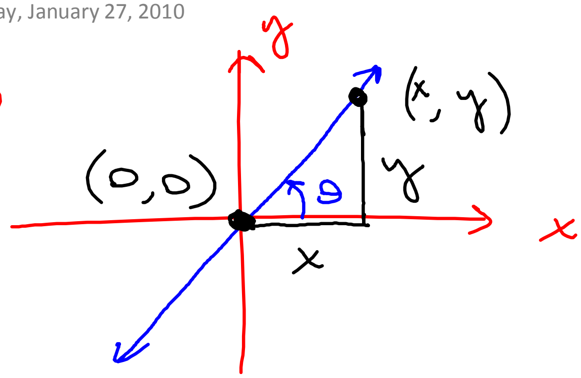

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{y - 0}{x - 0} = \frac{y}{x}$$

$$\tan\theta = \frac{y}{x}$$

$$m = \tan\theta$$

$$\frac{dm}{dt} = \sec^2\theta \frac{d\theta}{dt}$$

$$\frac{dm}{dt} = \frac{1}{\cos^2\theta} \frac{d\theta}{dt}$$

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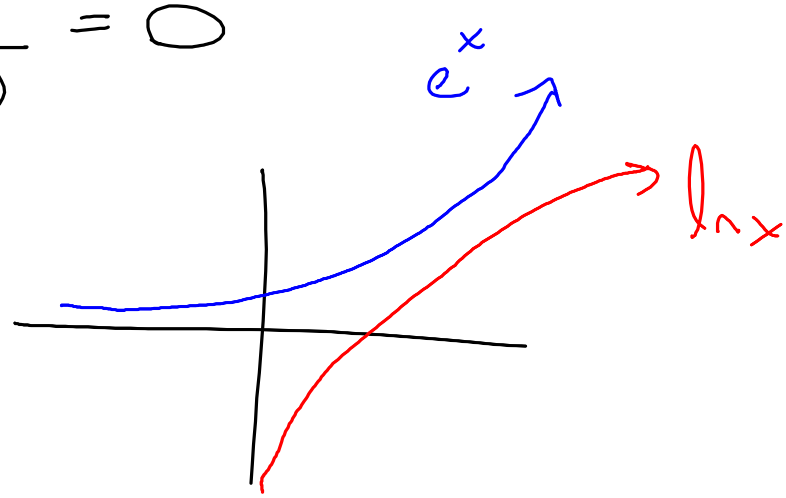
$$\lim_{x\to\infty} \frac{f(x)}{g(x)} = 0$$



~~(a)~~ $\frac{e^x}{x^2}$

~~(b)~~ $\frac{e^x}{\ln x}$

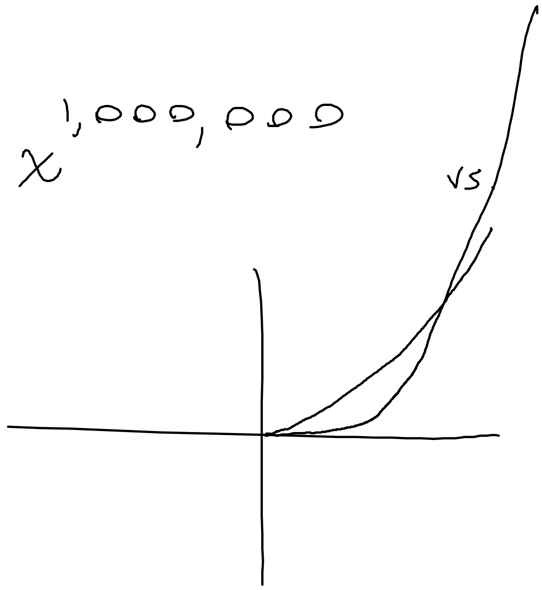
(d) $\frac{x}{\ln x} \Longrightarrow \frac{1}{1/x} = x$

(e) $\frac{3^x}{2^x}$

$$\frac{d}{dx} e^x \neq e^{x-1}$$

(c) $\frac{\ln x}{e^x} \Longrightarrow \frac{1/x}{e^x} = \frac{1}{xe^x}$

$x^{1,000,000}$ vs 1.1^{x}



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24) $h(x) = f(x)\,g(x)$

$$h'(x) = f(x)\,g'(x) + g(x)\,f'(x)$$

$$h'(3) = f(3)\,g'(3) + g(3)\,f'(3)$$

$$= 1 \cdot \underline{1} + 3 \cdot \underline{-1/3}$$

$$= 1 - 1 = 0$$

(22) $\frac{dy}{dx} = x^2 y^2 \qquad \frac{d^2y}{dx^2} = ?$

$$\frac{d^2y}{dx^2} = x^2 \cdot 2y\,\frac{dy}{dx} + y^2 \cdot 2x$$

$$= x^2 \cdot 2y \cdot x^2 y^2 + y^2 \cdot 2x$$

$$= 2x^4 y^3 + 2xy^2$$

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(18) $y = (x)\left((\ln x)^2\right) \neq x \cdot 2\ln x$

$$\frac{dy}{dx} = \cancel{x} \cdot 2(\ln x)^1 \cdot \frac{1}{\cancel{x}} + (\ln x)^2 \cdot 1$$

$$= 2\ln x + (\ln x)^2$$

$$= (\ln x)(2 + \ln x)$$

$$x(t) = \frac{1-t}{1+t}$$

$$x'(t) = v(t) = \frac{(1+t)(-1) - (1-t)(1)}{(1+t)^2}$$

$$= \frac{-1 \cancel{-t} - 1 \cancel{+t}}{(1+t)^2}$$

$$= -2(1+t)^{-2}$$

$$x''(t) = v'(t) = a(t) = 4(1+t)^{-3} \cdot 1$$

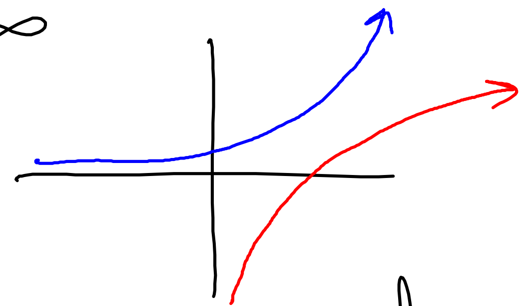
$$a(0) = 4(1)^{-3}$$

$$= 4$$

(25) $$\lim_{x \to \infty} \frac{f(x)}{g(x)}$$

$$\lim_{x \to \infty} \frac{e^x}{x^0} = \infty$$

$$\lim_{x \to \infty} \frac{e^x}{\ln x} = \infty$$



$$\lim_{x \to \infty} \frac{x}{\ln x} = \lim_{x \to \infty} \frac{1}{1/x} = \lim_{x \to \infty} x = \infty$$

$$\lim_{x \to \infty} \frac{3^x}{2^x} = \infty$$

$$\lim_{x \to \infty} \frac{\ln x}{e^x} = \lim_{x \to \infty} \frac{1/x}{e^x} = \lim_{x \to \infty} \frac{1}{x e^x}$$

$$x^{1,000,000,000,000,000} \text{ vs. } 1.0001^x$$

Reading

Introduction to Newtonian Dynamics

Newton's First Law

An object's velocity remains constant (either $v = 0$ or $v = k$) so long as the net force acting on the object is zero.

Inertia

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Newton's Second Law

commonly: $F = ma$ or $a = \frac{F}{m}$

$p \equiv$ momentum $\Rightarrow p = mv$

$$F = \frac{dp}{dt} = \frac{d(mv)}{dt} = m\frac{dv}{dt} + v\cancel{\frac{dm}{dt}}^{0}$$

if m is constant

$$F = m\frac{dv}{dt} \Rightarrow \boxed{F = ma}$$

Newton's Second Law

commonly known as $F = ma$

$$\frac{dp}{dt} = \frac{d(mv)}{dt} = m\frac{dv}{dt} + \cancel{v\frac{dm}{dt}}^{\,0}$$

if m constant, $\frac{dp}{dt} = m\frac{dv}{dt}$

$$\underbrace{\frac{dp}{dt}}_{F} = ma$$

$$F = ma$$

$$F = ma \Longrightarrow a = \frac{F}{m}$$

Some Particular Forces

gravitational

weight

normal force

friction

tension

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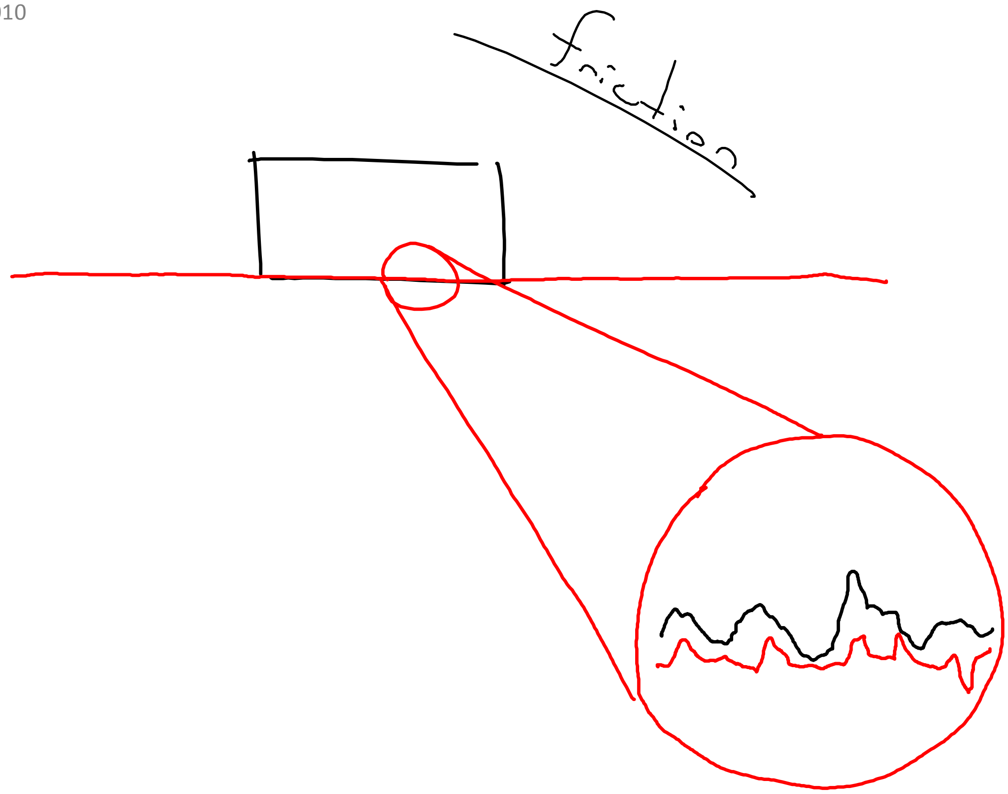

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HRW CHAPTER 5

3 5 1 2 3

(1) (5) (3) (1) (2)

$\underbrace{\qquad\qquad}_{\text{Questions}}$ $\underbrace{\qquad\qquad\qquad}_{\text{problems}}$