Math Review
for FE exam

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Solutions we did "in class"
(problem statements are
in separate word docs)

1st 3 problems are in "FE_Math_Review.docx"

1) $y = A x z^{1/3}$

$x = 3, y = 12, z = 8$

$$A = \frac{y}{x z^{1/3}} = 2$$

$y = ?$ @ $x = 70, z = 125$

$$x = \frac{y}{A z^{1/3}} = 7$$

This is the 1st problem in the "Relicense.org" web site mini quiz

21 $y = \int_2^5 (3x^2 + x - 5)\,dx$

$= x^3 + \frac{x^2}{2} - 5x \Big|_2^5$

$\therefore \quad y = 112.5$

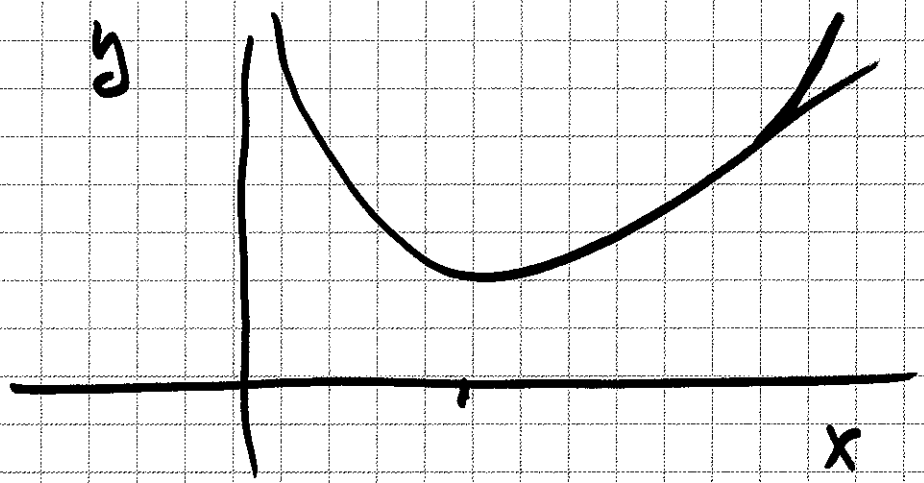
↑ from $\frac{5^2}{2}$

This is the 1st problem in the "EIT Quick Quiz" website

31 $y = 3x^2 - 4x + 9$

$y' = 6x - 4$

$= 0 \text{ @ } x = \frac{4}{6} = \frac{2}{3}$



No MAX $(\infty < x < \infty)$

This is the 2nd problem in the EIT Quick Quiz

All remaining orbs are from "~~FEMath.review.docx~~" "FEMath.doc"

4) $(D+2)^2 y = 0$

$$D \equiv \frac{d}{dx}$$

ie $$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4 = 0$$

LCC homogeneous

$$\therefore \quad y \sim e^{sx}$$

$$\frac{dy}{dx} = sy, \quad \frac{d^2y}{dx^2} = s^2 y$$

$$(s^2 + 4s + 4)\, y = 0$$

$$\therefore \quad s^2 + 4s + 4 = 0$$

$$\therefore \quad (s+2)^2 = 0$$

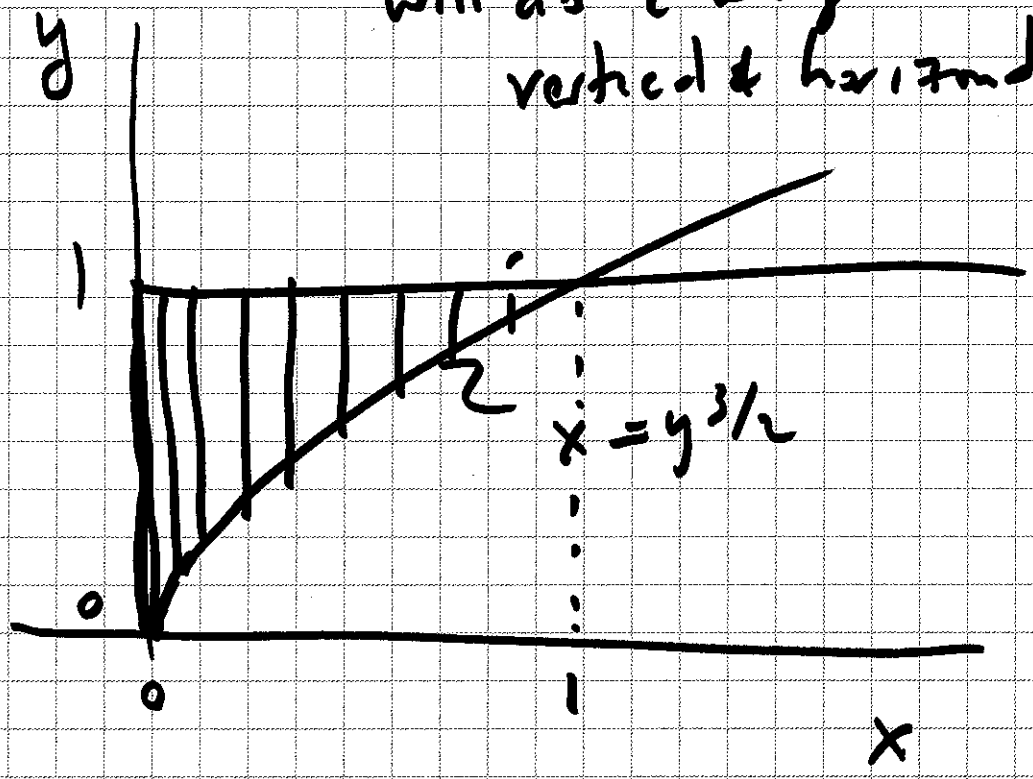
$\therefore \; s = \underbrace{-2, -2}_{\text{double root}}$

$\therefore \quad y = e^{-2x} + x e^{-2x}$

$\therefore$ $\boxed{y = (C_1 + C_2 x) e^{-2x}}$

ans. is (d)

7) will do 2 ways: vertical & horizontal



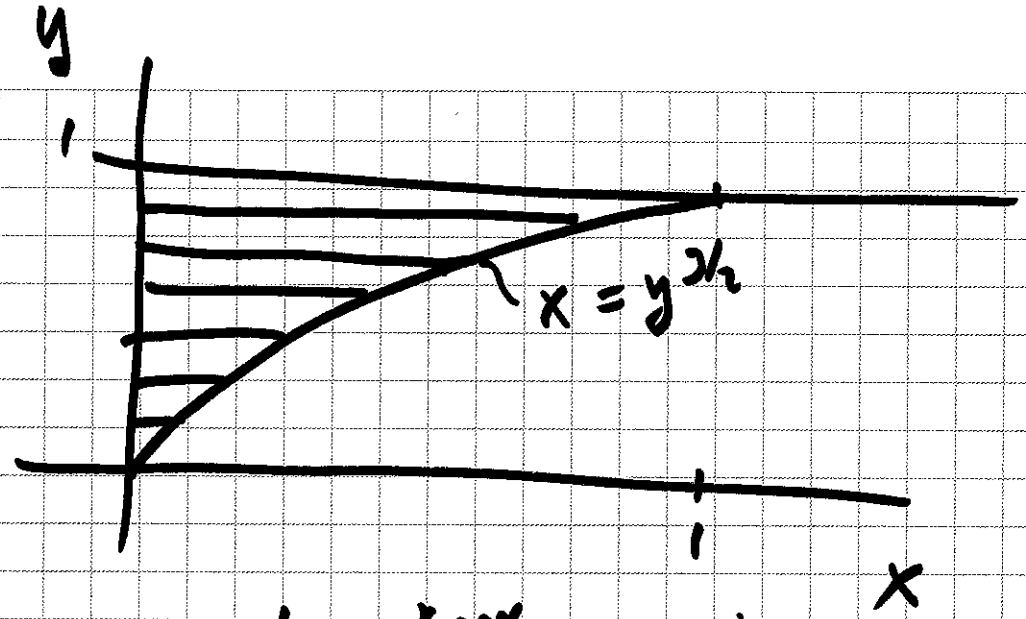
$$A = \int_0^1 \left[1 - x^{2/3}\right] dx$$

$$= x - \frac{x^{5/3}}{5/3}\Bigg|_0^1$$

$$= 1 - \frac{1}{5/3} - (0 - 0)$$

$$\boxed{A = 2/5} \quad (a)$$

or



$$A = \int_0^1 \left[\overbrace{y^{1/2}}^{x_{max}} - \overbrace{0}^{x_{min}} \right] dy$$

$$A = \left. \frac{y^{5/2}}{5/2} \right|_0^1 = \frac{2}{5} \qquad (a)$$

8-10

$$\ddot{x} + 16x = 0$$

$t = 0 \quad x = .08$

$\dot{x} = 0$

$x \sim e^{st} \Rightarrow s^2 + 16 = 0$

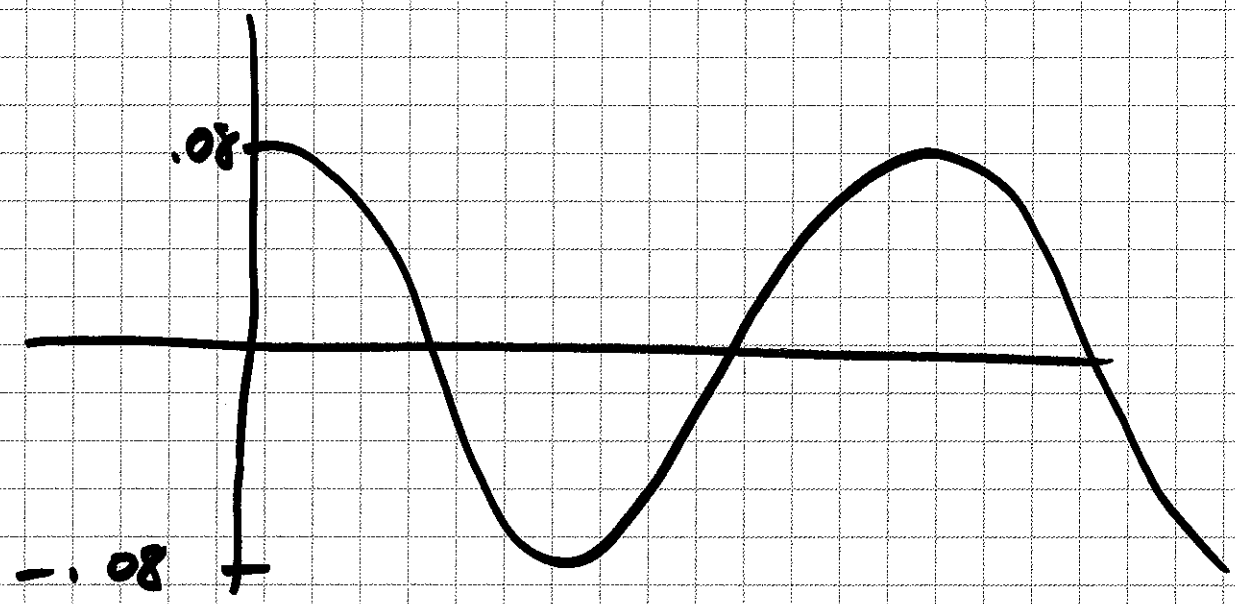
$\Rightarrow s = \pm 4i$

ie $\sin 4t \quad \& \quad \cos 4t$

$x = A \sin 4t + B \cos 4t$

(8) (d) $B = .08$

$A = 0$ matches i.c.



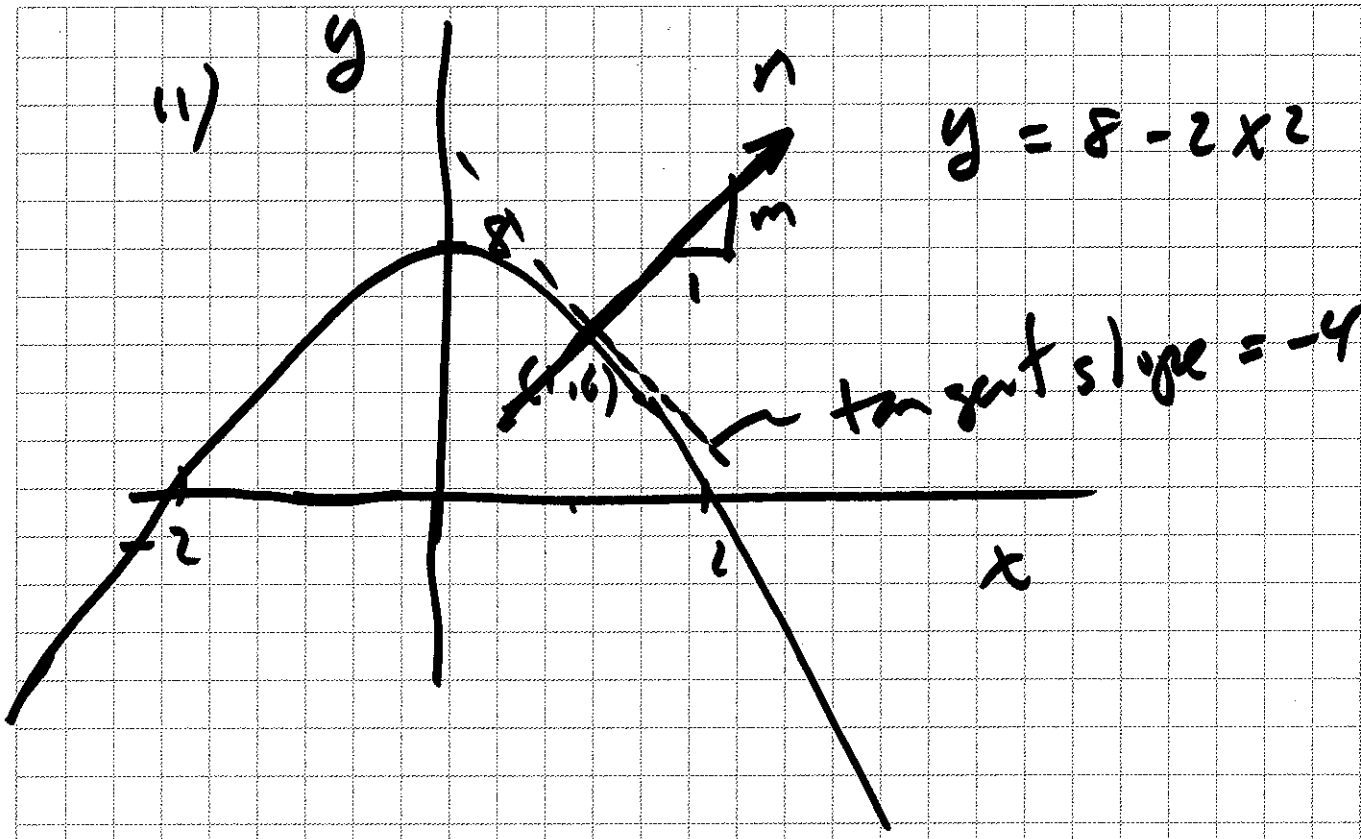
max $x = .08$

peak to peak $= .16$] either "right" (I don't know which they want)

(a) $4\Delta t = 2\pi$

period $= \frac{2\pi}{4} = \frac{\pi}{2}$ (a)

11)



$y = 8 - 2x^2$

$\frac{dy}{dx} = -4x = -4 \text{ @ } x = 1$

normal

$y - 6 = m \cdot (x - 1)$ (b)

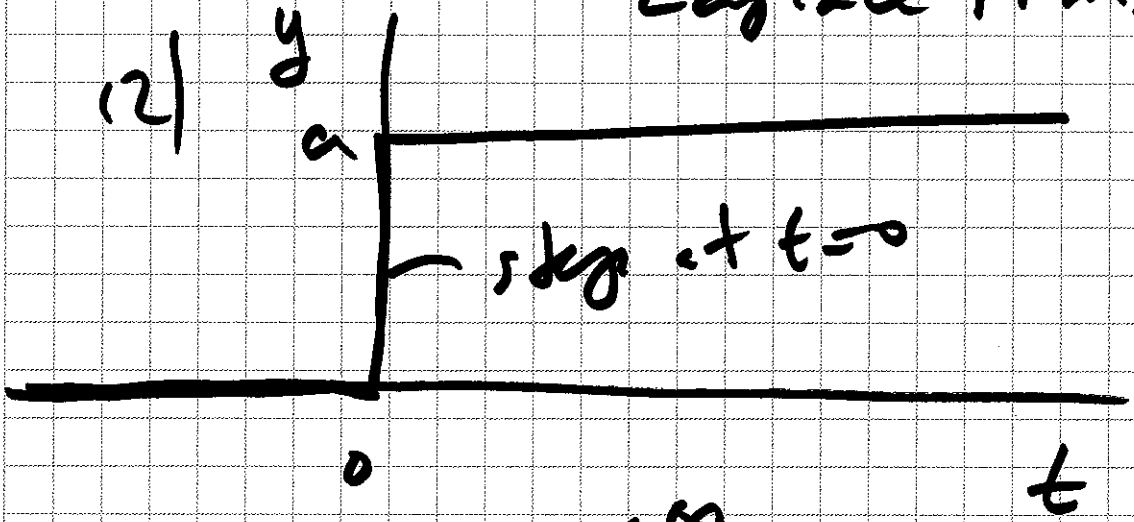
$\parallel$

$1/4$

remember: the more negative $\frac{dy}{dx}$ is the closer m will be to 0

Laplace Transform

(2)



$$\mathcal{L}[y] = \int_0^\infty e^{-st}\, y(t)\, dt$$

$$= \int_0^\infty e^{-st} \cdot a \, dt$$

$$= \boxed{\frac{a}{s}} \qquad (b)$$

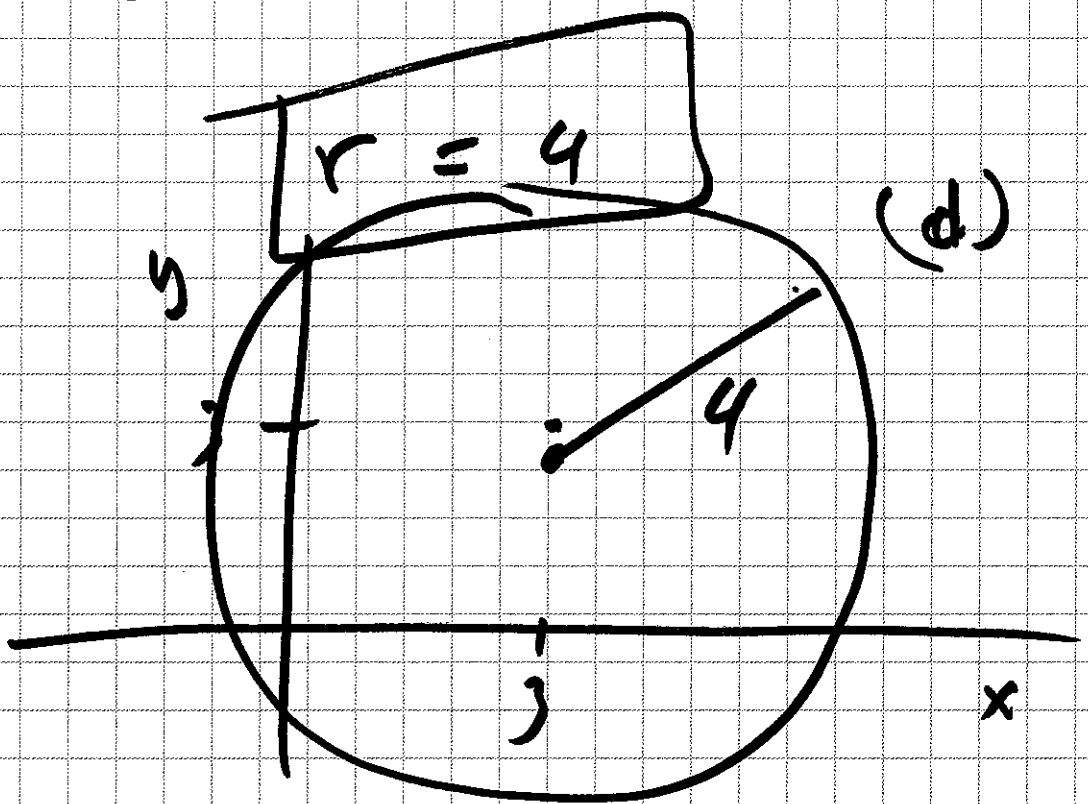
26) $x^2 - 6(x+y) + y^2 = -2$

complete the square:

$x^2 - 6x + y^2 - 6y = -2$

$(x-3)^2 - 9 + (y-3)^2 - 9 = -2$

$(x-3)^2 + (y-3)^2 = 16 = 4^2$



27) $\lim_{x \to 0} \frac{\sin x}{x}$

$$= \frac{\frac{d \sin x}{dx}}{\frac{dx}{dx}} \Bigg|_{x=0} = \frac{\cos x}{1} \Big|_{x=0}$$

$= 1$ L'Hospital's rule

or

$$\sin x = x - \frac{1}{3!} x^3 + \cdots$$ Taylor Series

$$\frac{\sin x}{x} = 1 - \frac{1}{3!} x^2 + \cdots$$

$= 1$ @ $x = 0$

NxN matrix

scalar (eigenvalue)

31) $B X = \lambda X$

Nx1 vector

$(B - \lambda I) \cdot X = 0$

possible iff

$$\det(B - \lambda I) = 0$$

(c)

you have to know they mean

$|C| = \det(C)$

Good Luck Saturday!

I encourage you to do all the problems in FEMath.doc