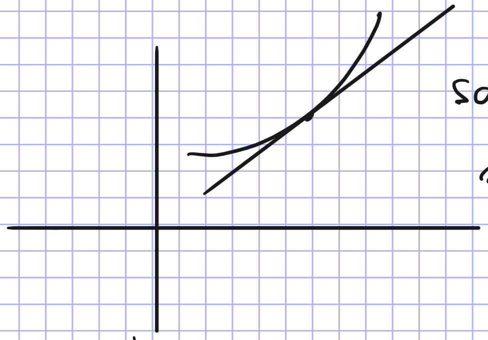
find a and b such that the line $y = 2x - 2$ tangent to the curve $y = ax^2 + b$ at the point $(1, 0)$

$(x\ y)$



same x

" y

" y'

$y = mx + b$

$y = 2x - 2$ $\qquad$ $y = ax^2 + b$

$y' = 2$ $\qquad$ $y' = 2ax$

$\boxed{y' = y'} \Rightarrow \cancel{2}ax = \cancel{2}1$ $\qquad$ $(1, 0)$

$ax = 1$

$a(1) = 1$ $\qquad$ $\boxed{a = 1}$ ✓

$y = 2x - 2$

$y = 1x^2 + b$

$y' = y'$

$y = y$

$x = 1$ $\qquad$ $y = 0$

$\boxed{0 = 2 - 2}$

$0 = 1^2 + b$ $\qquad$ $\boxed{b = -1}$

$\boxed{y = y}$

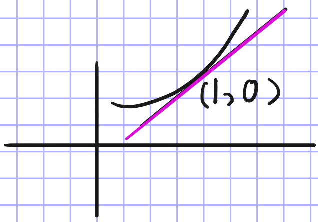
$\Downarrow$

$2x - 2 = x^2 + b$ $\qquad$ plug $x = 1$

$0 = 1 + b$ $\qquad$ $\boxed{b = -1}$

**

find a and b such that the line $y=2x-2$ tangent to the curve $y=ax^2+b$ at the point (1,0)
(x y)



same x
" y
" y'

$y=y$

$y'=2$

$y'=2ax$
$=2a(1)$
$=2a$

$y=(1)(x^2)+b$

$y=1x^2+b$

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

$\frac{2a}{2}=\frac{2}{2}$

$a=1$

$2(1)-2=(1)^2+b$

$2-2=1+b$

$0=1+b$

$-1=b$

$a=1$
$b=-1$

$y'=y'$
↓
a
$y=y$
↓
b

Quiz 10

$C=f(x,t)=te^{-t(5-x)}$

$f(2,t)=te^{-t(3)}$ $\quad t\geq 0$

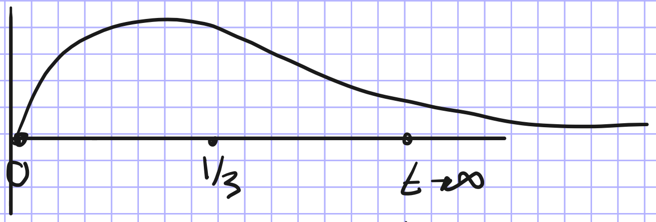
$f(t)=te^{-3t}$ $\quad t\geq 0$

$f'(t)=1e^{-3t}+te^{-3t}(-3)$

$f'(t)=e^{-3t}[1-3t]$

$e^{-3t}>0$ $\quad 1-3t=0$ $\quad 1=3t$

$t=1/3$



$t=0 \qquad f(t) = t e^{-3t} \qquad f(t) = 0$

$t = 1/3 \qquad f(1/3) = \frac{1}{3} e^{-3\cdot\frac{1}{3}} = \frac{1}{3} e^{-1} = \boxed{\frac{1}{3e}}$

$t \to \infty \qquad f(t) = \frac{t}{e^{3t}} \Rightarrow 0$

$e^{3t} >> t$

as $t \to \infty$

min $t=0$

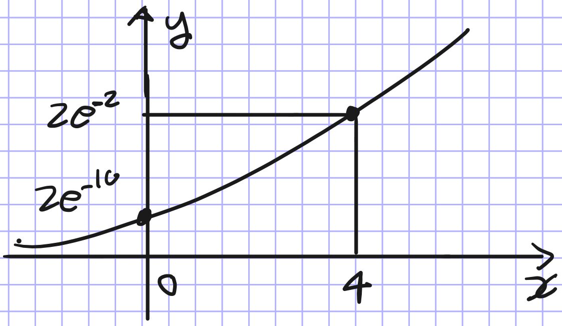
max $t = 1/3$

$$f(x,t) = t e^{-t(5-x)}$$

$$f(x,2) = 2 e^{-2(5-x)}$$

$$= 2 e^{-10+2x}$$

$$f(x,2) = 2 e^{-10} e^{2x}$$



$$f(x) = 2e^{-10+2x}$$

$0 \le x \le 4$

$x=0 \qquad f(0) = 2e^{-10+0} = 2e^{-10} \approx 0$

min

$x = \text{cri:}$

$x = 4 \qquad f(4) = 2e^{-10+8} = 2e^{-2}$

$f(x) = 2e^{\boxed{-10+2x}}$

$f'(x) = 2e^{-10+2x} \cdot (2)$

$f'(x) = 4e^{-10+2x} > 0$

$\frac{4e^{-10+2x}}{4} = \frac{0}{4}$

$e^{-10+2x} = 0$

$\ln e^{-10+2x} = \ln 0$ error

---

5) $H(x,t) = 120e^{-0.15t} \boxed{\sin \pi x}$

$H_x(x,t)$

$H_x = 120e^{-0.15t} \cdot \cos(\pi x) \cdot \pi$

$x = 0.2$

$H_x = 120e^{-0.15t} \cos[\pi(0.2)] \cdot \pi > 0$

$120e^{\wedge}(-0.15t) \cos(\text{Pi}(0.2))$

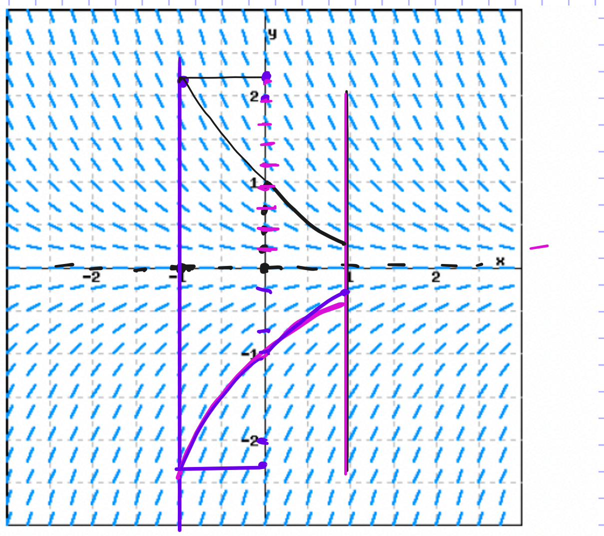
$120\pi e^{-0.15t} \cos(0.2\pi)$

$H(x,t) = 120e^{-0.15t}$ $\sin(\pi x)$

$H_x = 120e^{-0.15t} \cdot \cos(\pi x) \cdot \pi$

$H_x = 120\pi \cos(\pi x) e^{-0.15t}$

4) Q.4 Week 9



bmitted:

$y(0)$ — $y(1) = 0$ $y(-1) = 0$

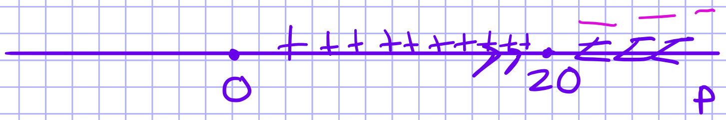
$y(1)$ — $y(1) = 0.25$ $y(-1) = 2.25$

$\frac{dP}{dt} = 0.05P(20-P) = 0$

$\frac{dP}{dt} = 0$ $P = 0$ $P = 20$

$0.05P = 0$ $P = 0$

$20 - P = 0$ $P = 20$



$P = 10$ $\quad \boxed{\frac{dP}{dt}} = 0.05P(20-P)$

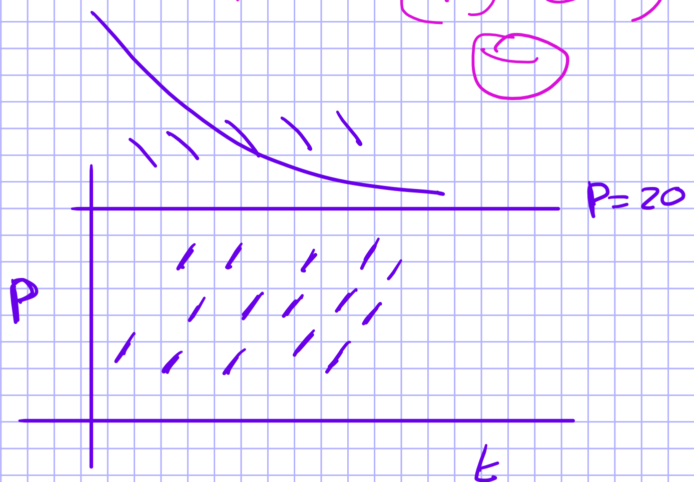
$= 0.05(10)(20-10) > 0$

$(0, 20)$ $\quad \frac{dP}{dt} > 0 \Rightarrow P \uparrow$

$P > 20$ $\quad = 0.05(30)(20-30)$

$= \quad (+) \quad (-10)$

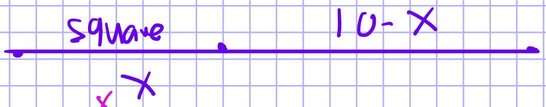
$\ominus$



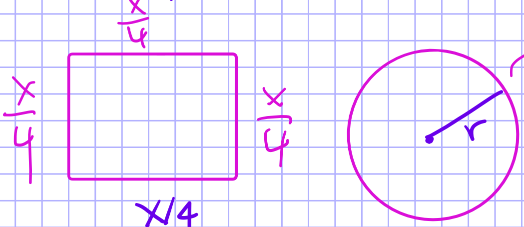
$(20, \infty)$ $\quad P \downarrow$

---

3)



Circumeren



$10 - x = 2\pi r$

$r = \frac{10-x}{2\pi}$

$$A = \left(\frac{x}{4}\right)^2 + \pi\left(\frac{10-x}{2\pi}\right)^2$$

$$A = \frac{x^2}{16} + \frac{\pi(10-x)^2}{(2\pi)^2}$$

$$A = \frac{1}{16}x^2 + \frac{\pi(10-x)^2}{4\pi^2}$$

$$A = \frac{1}{16}x^2 + \frac{1}{4\pi}(10-x)^2$$

$$\frac{dA}{dx} = \frac{1}{16}\cdot 2x + \frac{1}{4\pi}\cdot 2(10-x)(-1) = 0$$

$$\frac{dA}{dx} = \frac{x}{8} - \frac{2(10-x)}{4\pi} = 0$$

$$\frac{x}{8} = \frac{2(10-x)}{4\pi}$$

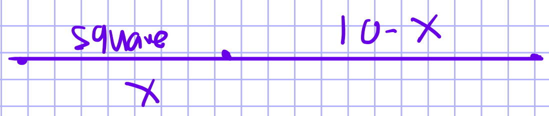
$$4\pi x = 8(2)(10-x)$$

$$4\pi x = 16(10) - 16x$$

$$4\pi x + 16x = 160$$

$$x(4\pi + 16) = 160$$

$$x = \boxed{\frac{160}{4\pi+16}} = \boxed{\frac{40}{\pi+4}}$$



$$\frac{dA}{dx} = \frac{x}{8} - \frac{2(10-x)}{4\pi} = 0$$

$$A' = \frac{x}{8} - \frac{2}{4\pi}(10-x)$$

$$A'' = \frac{1}{8} - \frac{2}{4\pi}(-1) = \frac{1}{8} + \frac{2}{4\pi} > 0 \quad \text{CU } \cup$$

min

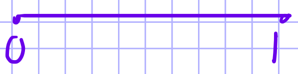
$$y(x_{new}) = y(x_{old}) + y'(x_{old})\Delta x$$

$$y(t_{n+1}) = y(t_n) + y'(t_n)\Delta t$$

$$\frac{dB}{dt} = 0.03B$$

$$B(0) = 1300$$

$$\Delta t = 1$$

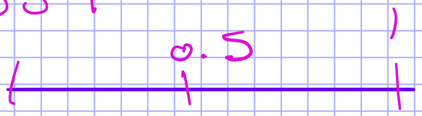


$$B(1) = B(0) + B'(0)\Delta t$$

$$B(1) = 1300 + 0.03\underbrace{B(0)}_{1300}(1)$$

$$= 1300 + 0.03(1300) = \underline{1339}$$

$$= 1339$$



B) $\Delta t = 0.5$ $\quad B(1)$

$$B(0.5) \simeq B(0) + B'(0)\Delta t$$

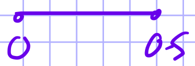
$$= 1300 + (0.03)(1300)(0.5)$$

$= 13195$

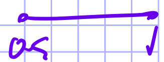
$B(1) = 13195 + (0.03)(13195)(0.5)$

$= 1389.2925$

$B(0.5) = B(0) + B'(0)\Delta t$



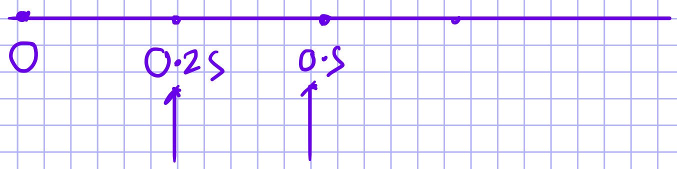
$B(1) = B(0.5) + B'(0.5)\Delta t$



$\Delta t = 1/4$

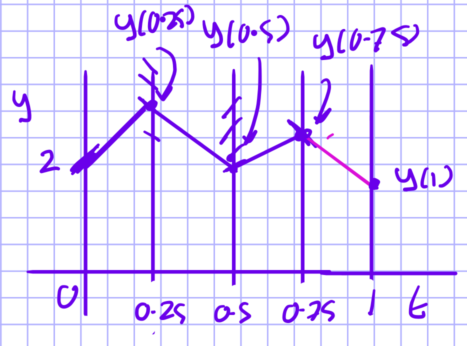
$B(0.25) = B(0) + B'(0)(0.25)$

$B(0.5) = B(0.25) + B'(0.25)(0.25)$



$B(0.75) = B(0.5) + B'(0.5)(0.25)$

$B(1) = B(0.75) + B'(0.75)(0.25)$



$$\frac{dy}{dt} = 4y + t \qquad y(0) = 1$$

$$y(1) = \square$$

2 steps

$$\Delta t = \frac{b-a}{n} = \frac{1-0}{2} = \boxed{\frac{1}{2}}$$

$$y(0.5) = y(0) + y'(0)\Delta t$$

$$y(0.5) = 1 + (4y(0) + 0)(0.5)$$

$$= 1 + (4(1) + 0)(0.5)$$

$$= 1 + (4)(0.5)$$

$$= 1 + 2$$

$$y(0.5) = 3$$

$$\frac{dy}{dt} = 4y(t) + t$$

$$\boxed{\frac{dy}{dt} = 4y + t}$$

$$y(1) = y(0.5) + y'(0.5)\Delta t$$

$$= 3 + (4y(0.5) + 0.5)(0.5)$$

$$= 3 + (4(3) + 0.5)(0.5)$$

$$= 3 + (12 + 0.5)(0.5)$$

$$= 3 + (12.5)(0.5)$$

$$= 3 + (6.25)$$

$$= \boxed{9.25}$$

$$e^x \cdot e^x = e$$

$$e^{2x}$$

$$e^x \cdot e^x =$$

$$\frac{e^{2x}}{e^x} = e^x$$

$$e^{2x-x} = e^x$$

$$y = \frac{e^x + e^{-x}}{e^x - e^{-x}}$$

$$\frac{dy}{dx} = e^x$$