Period 1, April 14, 2025

$$y - y_1 = m(x - x_1)$$

$(12, h(12))$ $\quad m = h'(12)$

$$y - h(12) = h'(12)(x - 12)$$
$$+h(12) \qquad +h(12)$$
$$y = h(12) + h'(12)(x - 12)$$

$H(t) = -t^3 - 3t^2 + 288t + 1300$

$H'(T) = -3T^2 - 6T + 288$

$H'(12) = -3(12)^2 - 6(12) + 288 = -216$

$L(T) = 2596 - 216(x - 12)$

$2000 = 2596 - 216(x - 12)$

$H(12) = 2596$

$y - 2596 = -216(x - 12)$

$2000 - 2596 = -216(x - 12)$

$-596 = -216(x - 12)$

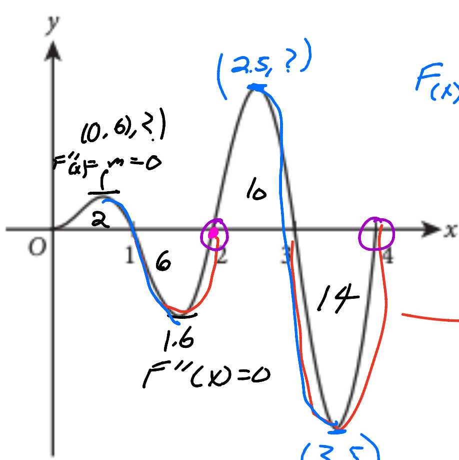
$-216 \qquad -216$

$2.759 = (x - 12)$

$+12 \qquad +12$

$x = 14.759$

(a)



Graph of f'

$F(x)$ is concave down when $F'(x)$ is decreasing

$F''(x) = -$ = slope of $F'(x)$

$(0.6, 1.6)$ and $(2.5, 3.5)$

$F(x)$ is decreasing $(1,2)$ $(3,4)$

Both $(1, 1.6) \cup (3, 3.5)$

ⓑ $\int_2^3 F'(x)dx = 5+10=15$ assume $(0,0)$ is $F(x)$

$F(2)=5$

$\int_2^4 F'(x)dx = 5+-4=1$

$\int_2^1 F'(x)dx = 5+6=11$

$\int_2^0 F'(x)dx = 5+4=9$ ← min

Min

Slope goes From negative to positive

(c) Evaluate $\int_0^4 f(x)f'(x)dx$.

$\int F(x)\cdot \cancel{F'(x)} \cdot \frac{du}{\cancel{F'(x)}}$

$U = F(x)$

$\frac{du}{dx} = F'(x)$

$du = F'(x)dx$

$\frac{du}{F'(x)} = dx$

$\int u\,du = \frac{1}{2}u^2 + C$

$\frac{1}{2}(F(x))^2 + C \Big|_0^4$

$\frac{1}{2}(F(4))^2 - \frac{1}{2}(F(0))^2$

$\frac{1}{2}(1)^2 - \frac{1}{2}(9)^2 = \frac{1}{2} - \frac{81}{2} = -\frac{80}{2}$

$= -40$

$g(x) = x^3 f(x)$.

Product Rule $g'(x) = 3x^2 \cdot F(x) + x^3 \cdot F'(x)$

$F(2)=5$

$F'(2)=0$

$g'(2) = 3(2)^2 \cdot F(2) + 2^3 \cdot F'(2)$

$g'(2) = 3\cdot 4 \cdot 5 + 8 \cdot 0$

$= 60 + 0$

~~27~~, ~~30~~, ~~21~~, ~~29~~, ~~18~~, ~~20~~, ~~14~~, ~~16~~, 17, 9, 2, 12, 11, 10

27.

$$\int_0^1 \frac{e^x}{(2-e^x)^2}\,dx$$

$u = 2 - e^x$

$\frac{du}{dx} = -e^x$

$\frac{du}{-e^x} = dx$

$$\int \frac{\cancel{e^x}}{u^2} \cdot \frac{du}{-\cancel{e^x}}$$

$$-\int u^{-2}\,du$$

$$-\frac{1}{-1}\,u^{-2+1=-1} = u^{-1} = \frac{1}{u} = \frac{1}{2-e^x}\Big[_0^1$$

$$\frac{1}{2-e^1} - \frac{1}{2-e^0} = \frac{1}{2-e^1} - \frac{1}{2-1}$$

$$\frac{1}{2-e} - 1 = \frac{1}{2-e} - \frac{2-e}{2-e}$$

$$= \frac{1-2+e}{2-e} = \boxed{\frac{e-1}{2-e}}$$

d

30.

$$\lim_{n\to\infty} \sum_{k=1}^{n} \left(\frac{3k}{n}+2\right)^2 \cdot \underbrace{\frac{3}{n}}_{dx}$$

$$\left(\underbrace{\frac{3\cdot 1}{n}+2}_{2}\right)^2 \cdot \underbrace{\frac{3}{1}}_{dx} \quad \text{and} \quad \left(\underbrace{\frac{3\cdot \cancel{4}}{\cancel{n}}+2}_{5}\right)^2 \cdot \underbrace{\frac{3}{n}}_{dx}$$

How Long

$2, dx$ $\qquad$ $5 \cdot dx$

$$\int_2^5$$

30. $\lim_{n\to\infty} \sum_{k=1}^{N} \left(\left(\frac{3k}{n}+2\right)^2 \cdot \underbrace{\frac{3}{n}}_{dx} \right)$ interval 3 units long

Let $k=1$ and Let $k=n$

$\lim_{n\to\infty} \left(\frac{3\cdot 1}{n}+2\right)^2$ and $\left(\frac{3\cdot \cancel{n}}{\cancel{n}}+2\right)^2$

$(2)^2$ and $(5)^2$

$\int_2^5 (x+2)^2\,dx$ $\quad$ $\int_0^3 (3x+2)^2\,dx$ $\quad$ $\int_2^5 (x^2)\,dx$ $\quad$ $\int_0^3 (x^2)\,dx$

7^2 and 4^2 $\quad$ 11^2 and 2^2 $\quad$ 5^2 and 2^2 $\quad$ 3^2 and 0^2

21.

$F'(x) = 2F(x)$ $\quad$ $F(2)=1$ $\quad$ $F(x)=$

e^{2x-4} $\quad$ $e^{2x}+1-e^4$ $\quad$ e^{4-2x} $\quad$ e^{x^2-4}

$e^{2x-4}\cdot 2$ $\quad$ $2e^{2x}+0-0$ $\quad$ $e^{4-2x}\cdot -2$ $\quad$ $e^{x^2-4}\cdot 2x$

✓ $\quad$ nope $\quad$ negative $\quad$ X

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29. $g(x) = F^{-1}(x)$ $\quad$ $g(4)=?$

$g'(4) = \frac{1}{F'(g(4))} = \frac{1}{F'(5)}$

$F(?)=4$

$F(5)=4$

$g(4)=5$

$F'(5)=$ Slope of $F(x)$ at $x=5$

$\frac{6-2}{8-2} = \cancel{\frac{4}{2}}\ \frac{4}{6} = \frac{2}{3}$

$g'(4) = \frac{1}{\frac{2}{3}} = \frac{3}{2}$ $\quad$ C

18. $\int_0^6 F(x-1)\,dx$

$u = x-1$ $\quad$ $6-1=5$

$du = dx$ $\quad$ $0-1=-1$

$\int_{-1}^{5} F(u)\,du$ $\quad$ B

20. average value

$\frac{1}{10}\cdot\int_0^{10} F(x)\,dx = \frac{1}{10}\left[\frac{1}{2}(8+3)\cdot 6+4\cdot 7\right]$

$\frac{1}{10}\left[\frac{1}{2}\cdot 11\cdot 6+28\right]$

$\frac{1}{10}\left[33+28\right]=\frac{61}{10}=6.1$

A

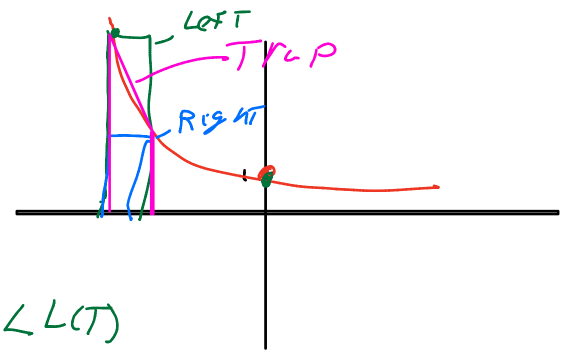
14. 16

$\lim_{x\to 1}\frac{2F(x)-6(g(x))}{4x^2-4e^{3(x-1)}}$ $\quad$ $\frac{2(F(1))-6(g(1))}{4(1)^2-4\cdot e^0}=\frac{2\cdot 1-6\cdot\frac{1}{3}}{4-4}=\frac{0}{0}$

$\lim_{x\to 1}\frac{2F(x)-6g(x)}{4x^2-4e^{3(x-1)}}=\lim_{x\to 1}\frac{2F'(x)-6g'(x)}{8x-4(e^{3x-3}\cdot 3)}=\frac{2\cdot 0-6\cdot -2}{8(1)-4\cdot 3\cdot e^0}=\frac{12}{8-12}=\frac{12}{-4}=-3$

A

(16). $A = \int_0^1 e^{-x}\,dx$



$R(T) < T(T) < L(T)$

$R(T) < \text{Real} < T(T) < L(T)$

17, 9, 2, 12, 11, 10

$y^2 = x - x^3$

Vertical Tangent $\frac{dy}{dx} = \phi = \frac{\#}{0}$

$2y\frac{dy}{dx} = 1 - 3x^2$

$\frac{dy}{dx} = \frac{1-3x^2}{2y}$ when $y=0$

$y^2 = x - x^3$

$y^2 = x(1-x^2)$

$y=0$ when $x = 0, 1, -1$ — Plug in so no $\frac{0}{0}$

3 Times

A

9.

$x = -$ and $y = +$

$\frac{dy}{dx} = +$

$x = +$ and $y = +$

$\frac{dy}{dx} = +$

$x = -$ and $y = -$

$\frac{dy}{dx} = -$

$x = +$ and $y = -$

$\frac{dy}{dx} = -$

$\frac{5}{y}$

$\cancel{\frac{5}{x}}$

$\cancel{\frac{x}{y}}$

$\cancel{5y}$

when y is big $\frac{dy}{dx}$ is close to zero

$$\lim_{h\to 0} \frac{\ln(2+h) - \ln 2}{h} = F'(2)$$

$$\lim_{h\to 0} \frac{F(x+h) - F(x)}{h} = F'(x)$$

$$\lim_{h\to 0} \frac{F(c+h) - F(c)}{h} = F'(c)$$

$F(x) = \ln(x)$

$F'(x) = \frac{1}{x} =$

$F'(2) = \frac{1}{2}$ B

10.

Max acc = LargesT Slope oF V(T)

(8,9)

d

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11. $\frac{1}{2}(6+3)\cdot 2$

Trap 9 Triangle $\frac{1}{2}(3)(4) = 6$

Right 9 LeFT 6

T=0 aT 0

T=6 RighT 9

T=9 RighT 3

12

T=8 S(T)=10

T=5

Triangle From 8 To 6

$\frac{1}{2}(2)(-4) = -4$

$\int_8^8 v(T)\,dT = 0$

Triangle From 6 To 5

$\frac{1}{2}(1)(2) = 1$

$\int_8^5 v(T)\,dT = 10 + 4 - 1 = 13$

C