LionTutors®

MATH140

Final Exam:
Review of Exams 1 and 2

Sample Test 1 - Solutions

Problem 1: C

$$\lim_{x \to 5^+} \frac{(5-x)(5+x)}{(5-x)(5-x)} = \lim_{x \to 5^+} \frac{5+x}{5-x} = \frac{\#}{0} \to \infty \text{ OR } -\infty$$

Plug in 5.1 to see if the answer will be $+\infty$ or $-\infty$

$$5.1 \to \frac{5+5.1}{5-5.1} = \frac{+}{-} = \boxed{-\infty}$$

Problem 2: C

When $x \to 7^+$, $(7-x)$ will be a negative number.

$$\lim_{x \to 7^+} \frac{14x - 2x^2}{-(7-x)}$$

$$= \lim_{x \to 7^+} \frac{2x(7-x)}{-(7-x)}$$

$$= \lim_{x \to 7^+} -2x = -2(7) = \boxed{-14}$$

Problem 3: C

Use the quotient rule

$$y' = \frac{\left((x+1)\frac{2}{3}x^{-1/3} - x^{2/3}(1)\right)3}{\left((x+1)^2\right)3}$$

$$y' = \frac{2x^{-1/3}(x+1) - 3x^{2/3}}{3(x+1)^2}$$

$$y' = \frac{x^{-1/3}\left(2(x+1) - 3x\right)}{3(x+1)^2}$$

$2x + 2 - 3x$
$2 - x$

$$y' = \frac{2-x}{3x^{1/3}(x+1)^2}$$

Problem 4: B

point: $(1, 4)$ → Found by evaluating $f(1)$.

slope: 9 → Found by evaluating $f'(1)$

$$f(1) = \frac{1}{2}\left(\frac{1+3}{3-1}\right)^3 = \frac{1}{2}\left(\frac{4}{2}\right)^3 = \frac{1}{2}(8) = 4$$

*

$$f'(x) = 3 \cdot \frac{1}{2}\left(\frac{x+3}{3-x}\right)^2 \cdot \left(\frac{(3-x)(1) - (x+3)(-1)}{(3-x)^2}\right)$$

$3 - x + (x+3)$
$3 - x + x + 3$
6

$$= \frac{3}{2}\left(\frac{x+3}{3-x}\right)^2\left(\frac{6}{(3-x)^2}\right)$$

$$f'(1) = \frac{3}{2}(2)^2\left(\frac{6}{(2)^2}\right) = \frac{3}{2}(4)\left(\frac{6}{4}\right) = 9$$

* when taking $f'(x)$ use chain rule overall, with a quotient rule to take the derivative of the inside function.

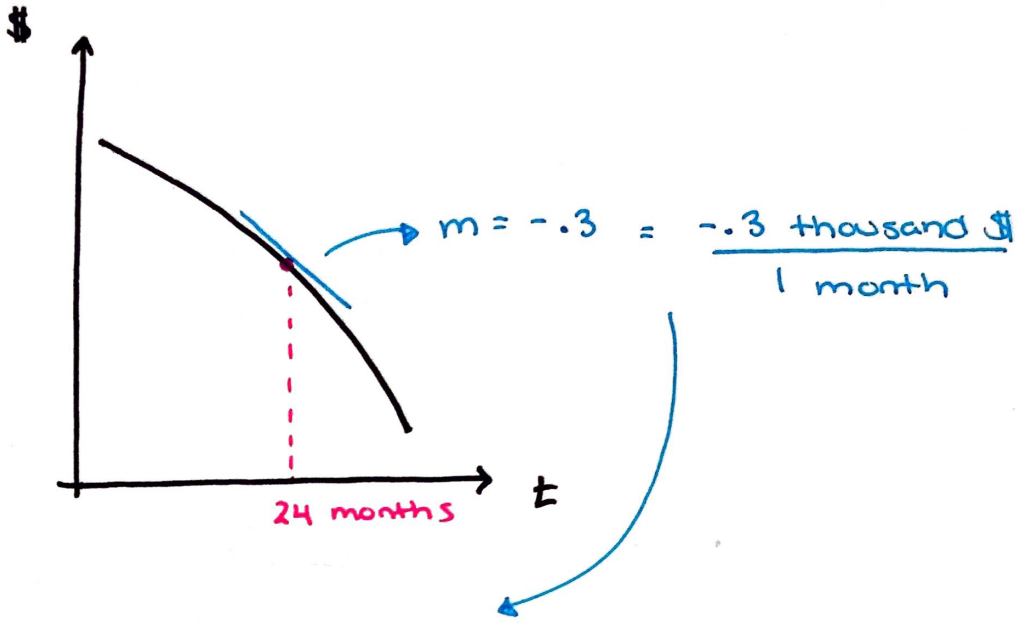
$$y - y_1 = m(x - x_1)$$
$$y - 4 = 9(x - 1)$$
$$y = 9x - 9 + 4$$

$$\boxed{y = 9x - 5}$$

Problem 5: C

$V = f(t)$

- V: Value in thousands of $ (y-axis)
- t: time in months (x-axis)

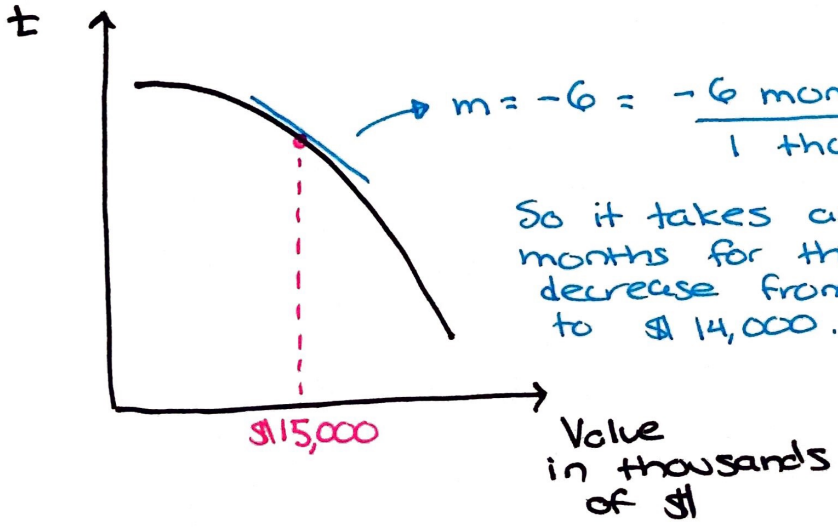


From 24 to 25 months, the car will decrease by approx. $-.3(1000) = 300.

Problem 5: B

$V = f(t) \rightarrow f^{-1}(V) = t$

- $V = f(t)$: Value (y), time (x)
- $f^{-1}(V) = t$: Value (x), time (y)



So it takes approx. 6 months for the value to decrease from $15,000 to $14,000.

Problem 7: B

$f(x) = \sqrt[3]{x^2 - 4x + 1}$ is continuous for all x, so the IVT can be applied.

$f(-1) = \sqrt[3]{1 + 4 + 1} = +\#$

$f(0) = \sqrt[3]{1} = +\#$

$f(1) = \sqrt[3]{1 - 4 + 1} = -\#$

$f(2) = \sqrt[3]{4 - 8 + 1} = -\#$

Going from 0 to 1 is the only interval where $f(x)$ changes signs.

Problem 8: B

$$y = e^{x\ln x}$$

$$\frac{dy}{dx} = e^{(x\ln x)} \cdot \left(x \cdot \frac{1}{x} + \ln x \cdot (1)\right)$$

$$\frac{dy}{dx} = e^{x\ln x}(1 + \ln x)$$

Problem 9: B

$$(f^{-1})'(1) = \frac{1}{f'(f^{-1}(1))} = \frac{1}{f'(0)} = \frac{1}{3}$$

$f^{-1}(1) = x \rightarrow f(x) = 1$? (where does $f(x) = 1$?)

$x^7 + 3x + 1 = 1$

$(0)^7 + 3(0) + 1 = 1$

$x = 0 \rightarrow f(0) = 1 \rightarrow f^{-1}(1) = 0$

$f'(x) = 7x^6 + 3$

$f'(0) = 3$

Problem 10: E

point: $(2,1)$

slope: $-\frac{5}{8}$

↳ Use implicit. There will be a product rule for the first 2 terms.

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

$$x^2\frac{dy}{dx} + y(2x) + x2y\frac{dy}{dx} + y^2(1) = 0$$

Plug in $(2,1)$

$$4\frac{dy}{dx} + 4 + 4\frac{dy}{dx} + 1 = 0$$

$$8\frac{dy}{dx} = -5$$

$$\frac{dy}{dx} = -\frac{5}{8}$$

Equation:

$$y - 1 = -\frac{5}{8}(x-2)$$

$$y - 1 = -\frac{5}{8}x + \frac{5}{4}$$

$$y = -\frac{5}{8}x + \frac{9}{4}$$

Problem 11: C

Use logarithmic diff.:

$$y = (\sin x)^{x^2}$$

$$\ln y = \ln(\sin x)^{x^2}$$

$$\ln y = x^2 \cdot (\ln(\sin x))$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \left(x^2 \cdot \frac{1}{\sin x} \cdot \cos x + \ln(\sin x) \cdot 2x \right)$$

$$\frac{dy}{dx} = \left(x^2 \cot(x) + 2x \ln(\sin x) \right) y$$

$$\frac{dy}{dx} = \left(x^2 \cot(x) + 2x \ln(\sin x) \right) (\sin x)^{x^2}$$

Problem 12: B

$f(x)$ is cont. and diff. on $[-1,2]$ so we can apply MVT.

$[-1,2]$

$a \quad b$

$$\frac{f(b)-f(a)}{b-a} = f'(x)$$

$$\frac{f(2)-f(-1)}{2-(-1)} = f'(x)$$

$$\frac{\overbrace{\left(7-(2)^2\right)}^{3}-\overbrace{\left(7-(-1)^2\right)}^{6}}{3} = f'(x)$$

$$-1 = f'(x)$$

$$-1 = -2x$$

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

Problem 13: C

Note that $x \neq 0$ because of the domain of $f(x)$.

$$f'(x) = \frac{x \cdot \frac{2}{3}(x-2)^{-1/3} - (x-2)^{2/3}(1)}{(x)^2}$$

$$= \frac{2x}{3(x-2)^{1/3}} - \frac{(x-2)^{2/3}}{1}\left(\frac{3(x-2)^{1/3}}{3(x-2)^{1/3}}\right)$$

$\rightarrow 3(x-2)^{2/3} \cdot (x-2)^{1/3} = 3(x-2)$

$$= \frac{\frac{2x - (3(x-2))}{3(x-2)^{1/3}}}{x^2} = \frac{2x - 3x + 6}{3(x-2)^{1/3} \cdot x^2} = \frac{6-x}{3(x-2)^{1/3}x^2}$$

$6 - x = 0$

$x = 6$

$3(x-2)^{1/3}(x^2) = 0$

$x = 2, \quad x = 0$

↳ not in domain of $f(x)$

C. N. : $x = 2, x = 6$

Problem 14: A

$f'(x) = \cos x - \sin x$

$0 = \cos x - \sin x$

$\sin x = \cos x$

$x = \frac{\pi}{4}$, ~~$x = \frac{5\pi}{4}$~~ ← not in interval

x	$f(x) = \sin x + \cos x$
0	$0 + 1 = 1$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} = \frac{2\sqrt{2}}{2} = \sqrt{2}$ → M
π	$0 - 1 = -1$ → m

Problem 15: B

$$f''(x) = \frac{2x^3 e^{x-1}}{(x-5)^3 (x+1)^{2/3}}$$

$2x^3 e^{x-1} = 0$ $\qquad$ $(x-5)^3 (x+1)^{2/3} = 0$

$2x^3 = 0$ $\quad$ ~~$e^{x-1} = 0$~~ $\qquad$ $x = 5, \; x = -1$

$x = 0$

$$f''(x) = \frac{2x^3 e^{x-1}}{(x-5)^3 (x+1)^{2/3}}$$

always +

always +

C.D. $(0, 5)$

Problem 16: E

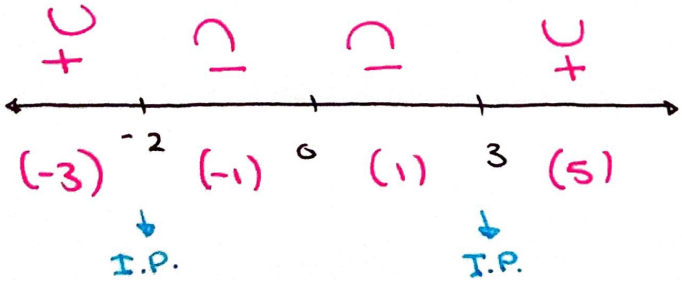
$$f'(x) = \frac{1}{5}x^5 - \frac{1}{4}x^4 - 2x^3$$

$$f''(x) = x^4 - x^3 - 6x^2$$

$0 = x^2(x^2 - x - 6)$

$0 = x^2(x-3)(x+2)$

$x = 0, \; x = 3, \; x = -2$



$$f''(x) = \underbrace{x^2}_{+}(x-3)(x+2)$$

Problem 17

If $f''(c) = 0$, then $f(x)$ has an inflection point at $x = c$.
FALSE. The concavity must also change at that point.

If f has a local maximum or local minimum at $x = c$ and $f'(c)$ exists, then $f'(c) = 0$.
TRUE. Fermat's Theorem.

If f is continuous on [2,4], differentiable on (2,4), and $f(2) = f(4)$, then there must exist some number c in the interval (2,4) such that $f'(c) = 0$
TRUE. Rolle's Theorem.

Problem 18

$$\lim_{x \to \pi} \frac{f(x) - f(\pi)}{x - \pi} = \lim_{x \to \pi} \frac{e^{2x}\cos(x^2) - e^{2\pi}\cos(\pi^2)}{x - \pi}$$

Note that you there are other correct answers if you chose to use the other limit definition of a derivative.

Problem 19:

Use implicit with a product rule on both sides:

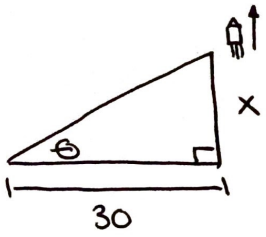
$$y\cos(x^2)\cdot 2x + \sin(x^2)\frac{dy}{dx} = x\cos(y^2)\cdot 2y\frac{dy}{dx} + \sin(y^2)$$

$$\frac{dy}{dx}\left(\sin(x^2) - 2xy\cos(y^2)\right) = \sin(y^2) - 2xy\cos(x^2)$$

$$\frac{dy}{dx} = \frac{\sin(y^2) - 2xy\cos(x^2)}{\sin(x^2) - 2xy\cos(y^2)}$$

Problem 20:

Related Rates



$\tan\theta = \frac{x}{30}$

$30\tan\theta = x$

$30\sec^2\theta\cdot\frac{d\theta}{dt} = \frac{dx}{dt}$

$30\sec^2\theta\cdot\frac{d\theta}{dt} = 250$

$30\left(\frac{5}{3}\right)^2\frac{d\theta}{dt} = 250$

$\frac{750}{9}\frac{d\theta}{dt} = 250$

$\frac{d\theta}{dt} = 250\cdot\frac{9}{750} = \boxed{3\ \text{rad/s}}$

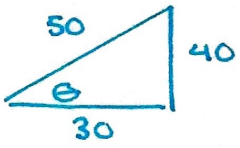
$x = 40$

$\theta =$

$\frac{dx}{dt} = 250$

$\frac{d\theta}{dt} = ?$

when $x = 40$

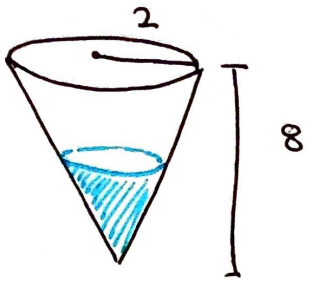


* can use SOH CAH TOA to find $\sec\theta$

$\sec\theta = \frac{H}{A} = \frac{50}{30} = \frac{5}{3}$

Problem 21:

Related Rates



$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi\left(\frac{1}{4}h\right)^2 h$

$V = \frac{1}{3}\cdot\frac{1}{16}\pi h^3$

$\frac{dV}{dt} = \frac{1}{16}\pi h^2 \frac{dh}{dt}$

$12 = \frac{1}{16}\pi(4)^2 \frac{dh}{dt}$

$\boxed{\frac{dh}{dt} = \frac{12}{\pi}\ ft/s}$

$V =$

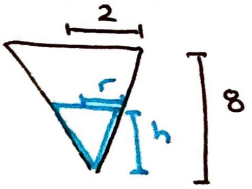
$r =$

$h = 4$

$\frac{dV}{dt} = 12$

$\frac{dr}{dt} =$ → missing, so eliminate r from equation

$\frac{dh}{dt} = ?$



$\frac{2}{8} = \frac{r}{h}$

$2h = 8r$

$r = \frac{1}{4}h$

Problem 22

$$f(x) = \begin{cases} bx^2 - 3ax - 12 & x \le 1 \\ ax + b & x > 1 \end{cases}$$

Continuous:

$bx^2 - 3ax - 12 = ax + b$ → plug in $x = 1$

$b - 3a - 12 = a + b$

$-12 = 4a$

$\boxed{a = -3}$

Diff.:

$\frac{d}{dx}(bx^2 - 3ax - 12) = \frac{d}{dx}(ax + b)$

$2bx - 3a = a$ → plug in $x = 1$, $a = -3$

$2b(1) - 3(-3) = -3$

$2b = -12$

$\boxed{b = -6}$

Problem 23:

To find where the tangent line is horizontal, set $f'(x)=0$.

$$3^{x+1} - 5 = 0$$

$$3^{x+1} = 5$$

$$\ln 3^{x+1} = \ln 5$$

$$(x+1)\ln 3 = \ln 5$$

$$x\ln 3 + \ln 3 = \ln 5$$

$$x\ln 3 = \ln 5 - \ln 3$$

$$x = \frac{\ln 5 - \ln 3}{\ln 3}$$

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MATH140

Final Exam:
Review of Exams 1 and 2

Sample Test 2 - Solutions

Problem 1: C

Switch x and y, solve for y.

$$y = \frac{5 - e^{2x}}{1 + e^{2x}}$$

$$x = \frac{5 - e^{2y}}{1 + e^{2y}}$$

$$x + xe^{2y} = 5 - e^{2y}$$

$$xe^{2y} + e^{2y} = 5 - x$$

$$e^{2y}(x + 1) = 5 - x$$

$$e^{2y} = \frac{5 - x}{x + 1}$$

$$2y = \ln\left(\frac{5 - x}{x + 1}\right)$$

$$y = \frac{1}{2}\ln\left(\frac{5 - x}{x + 1}\right)$$

$$f^{-1}(x) = \frac{1}{2}\ln\left(\frac{5 - x}{x + 1}\right)$$

Problem 2: C

$$\lim_{x \to 3} \frac{(2x+1)(x-3)}{(x-3)(x+2)} = \frac{2(3)+1}{3+2} = \boxed{\frac{7}{5}}$$

Problem 3: D

$$\lim_{x \to 4^+} \frac{x(4+x)}{(4-x)(4+x)} = \lim_{x \to 4^+} \frac{x}{4-x} = \frac{\#}{0} \rightarrow \text{answer will be } \infty \text{ or } -\infty$$

Plug in $4.1 \rightarrow \frac{4.1}{4-4.1} = \frac{+}{-} = \boxed{-\infty}$

Problem 4: C

$$\lim_{x \to -2} \frac{6-3x}{2+|x|}$$

→ At $x = -2$, $|x| = -(x)$ since x is negative

$$= \lim_{x \to -2} \frac{6-3x}{2+(-x)} = \lim_{x \to -2} \frac{3(2-x)}{2-x} = \boxed{3}$$

Problem 5: D

To be continuous we want:

$$cx^2 + 10x = x^3 - \cdot\cos(\pi x) \quad \text{at} \quad x = 1$$

$$c(1)^2 + 10c = (1)^3 - \cdot\cos(\pi)$$

$$c + 10c = 1 - \cdot(-1)$$

$$c + 10c = 1 + 1$$

$$11c = 2$$

$$\boxed{c = \frac{2}{11}}$$

Problem 6: B

Average Velocity: $\frac{s(4) - s(1)}{4 - 1}$

$$= \frac{(4^3 + 4) - (1^3 + 1)}{3} = \frac{68 - 2}{3} = \boxed{22 \text{ m/s}}$$

Instantaneous Velocity: $s'(3)$

$$s'(t) = 3t^2 + 1$$

$$s'(3) = 3(9) + 1 = \boxed{28 \text{ m/s}}$$

Problem 7: C

Use the product rule with a chain rule

$$f'(x) = x \cdot \frac{1}{3}(5x+1)^{-2/3}(5) + (5x+1)^{1/3}(1)$$

$$= \frac{5x}{3(5x+1)^{2/3}} + (5x+1)^{1/3}\left(\frac{3(5x+1)^{2/3}}{3(5x+1)^{2/3}}\right)$$

$$= \frac{5x + 3(5x+1)^{1}}{3(5x+1)^{2/3}} \quad \rightarrow \; 15x+3$$

$$= \frac{20x+3}{3(5x+1)^{2/3}}$$

Problem 8: A

$$s(t) = \sec^2(t) = (\sec(t))^2$$

Use chain rule to take derivative:

$$v(t) = 2 \cdot \sec(t) \cdot (\sec(t) \cdot \tan(t))$$

$$= 2\sec^2(t) \cdot \tan(t)$$

$$= (2(\sec(t))^2)(\tan(t))$$

Now use product rule and chain rule to take the derivative again:

$$a(t) = (2\sec^2(t)) \cdot \sec^2(t) + (\tan(t))(4\sec(t))(\sec(t)\tan(t))$$

$$= 2\sec^4(t) + 4\sec^2(t)\tan^2(t)$$

$$a\left(\frac{\pi}{4}\right) = 2\sec^4\left(\frac{\pi}{4}\right) + 4\sec^2\left(\frac{\pi}{4}\right)\tan^2\left(\frac{\pi}{4}\right)$$

$$= 2\left(\frac{2}{\sqrt{2}}\right)^4 + 4\left(\frac{2}{\sqrt{2}}\right)^2(1)^2$$

$$= 2\left(\frac{16}{4}\right) + 4\left(\frac{4}{2}\right)$$

$$= 8 + 8$$

$$= 16 \text{ m/s}^2$$

Problem 9: C

$$y = (5 - 3e^{2x})^{1/2}$$

$$\frac{dy}{dx} = \frac{1}{2}(5-3e^{2x})^{-1/2} \cdot (-3e^{2x} \cdot (2))$$

$$\frac{dy}{dx} = \frac{-3e^{2x}}{\sqrt{5-3e^{2x}}}$$

Problem 10: D

Use a product rule overall:

$$\frac{dy}{dx} = x \cdot \frac{1}{\sqrt{1-(x^3)^2}} \cdot 3x^2 + \sin^{-1}(x^3) \cdot (1)$$

$$\frac{dy}{dx} = \frac{3x^3}{\sqrt{1-x^6}} + \sin^{-1}(x^3)$$

Problem 11: A

$$(f^{-1})'(4) = \frac{1}{f'(f^{-1}(4))} = \frac{1}{f'(2)} = \frac{1}{5}$$

where does $f(x)=4$?

$4 = x^2 + \ln(x-1)$

at $x=2$

$4 = (2)^2 + \ln(1)$

$4 = 4$ ✓

So $f(2)=4 \rightarrow f^{-1}(4)=2$

$f'(x) = 2x + \frac{1}{x-1}$

$f'(2) = 2(2) + \frac{1}{2-1} = 5$

Problem 12: D

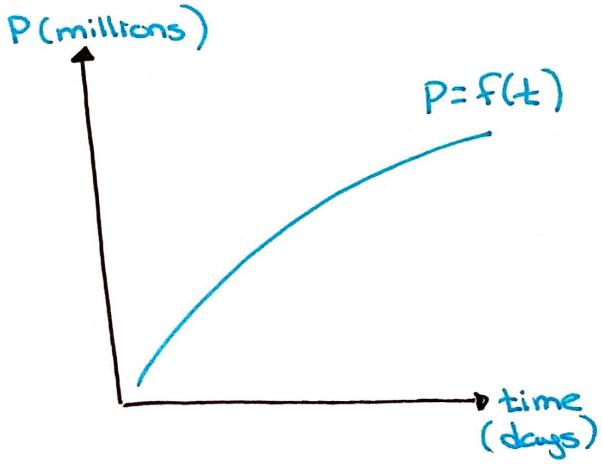
$P = f(t) \longrightarrow f^{-1}(P) = t$

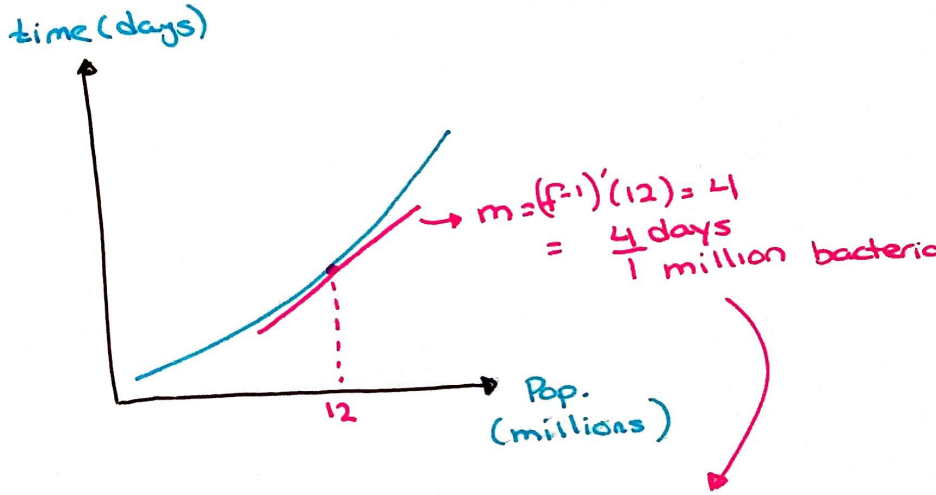
P: population in millions (y-axis)

t: time in days (x-axis)

P: pop. in millions (x-axis)

t: time in days (y-axis)





So at $P=12$, it takes approximately 4 days for the population to increase by 1 million, or...

It takes approx 4 days to go from 12 mil to 13 mil bacteria.

Problem 13: A

$e^{xy} - x^7 = y^8 + 3$ → use implicit

$$e^{xy} \cdot \left(x \frac{dy}{dx} + y(1) \right) - 7x^6 = 8y^7 \frac{dy}{dx}$$

$$xe^{xy}\frac{dy}{dx} + ye^{xy} - 7x^6 = 8y^7 \frac{dy}{dx}$$

$$ye^{xy} - 7x^6 = \frac{dy}{dx}\left(8y^7 - xe^{xy}\right)$$

$$\frac{dy}{dx} = \frac{ye^{xy} - 7x^6}{8y^7 - xe^{xy}}$$

Problem 14: D

Use logarithmic diff.

$$y = x^{10x}$$

$$\ln y = \ln x^{10x}$$

$$\ln y = (10x)\cdot \ln x$$

$$\frac{1}{y}\cdot\frac{dy}{dx} = \left(10x\cdot\frac{1}{x} + \ln x\cdot(10)\right)$$

$$\frac{dy}{dx} = \left(10 + 10\ln x\right)y$$

$$\frac{dy}{dx} = \left(10 + 10\ln x\right)x^{10x}$$

Problem 15: D

$f(x) = \sqrt{x}$, $a = 16$

point: $(16, 4)$

slope: $\frac{1}{8}$

↳ $f'(x) = \frac{1}{2\sqrt{x}}$, $f'(16) = \frac{1}{2(4)} = \frac{1}{8}$

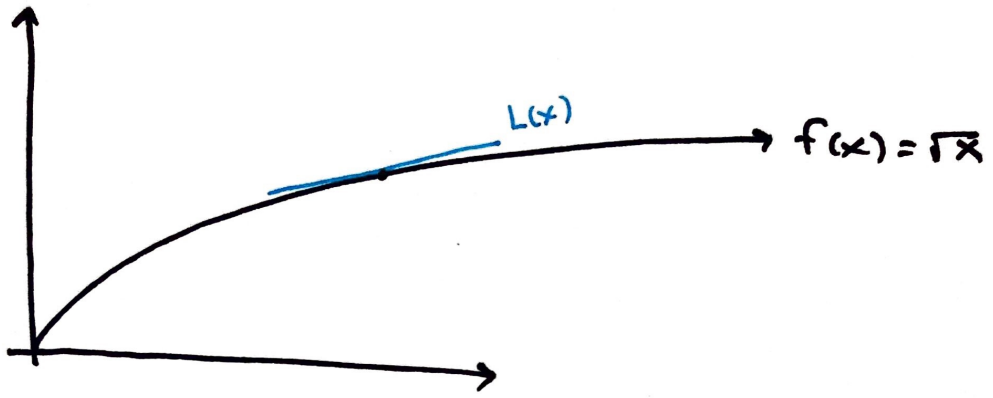
$$L(x) = 4 + \frac{1}{8}(x-16)$$

Plug in 15.8

$$L(15.8) = 4 + \frac{1}{8}(-.2) = 4 - .025 = 3.975$$

Problem 16

It will be an <u>over</u> approximation.



The tangent line always lies <u>above</u> f(x), so using L(x) to approximate will always be a little higher than the actual value of f(x).

Problem 17:

$$f'(x) = \frac{(x-2)(2x) - x^2(1)}{(x-2)^2} = \frac{2x^2-4x-x^2}{(x-2)^2}$$

$$= \frac{x^2-4x}{(x-2)^2} = \frac{x(x-4)}{(x-2)^2}$$

$x(x-4) = 0$

~~$x = 0$~~ NOT IN INTERVAL

$x = 4$

$(x-2)^2 = 0$

~~$x = 2$~~ NOT IN INTERVAL

x	$f(x) = \frac{x^2}{x-2}$
3	$\frac{9}{1} = 9$
4	$\frac{16}{2} = 8$
7	$\frac{49}{5}$ → greater than 9

$m = 8$, $M = \frac{49}{5}$

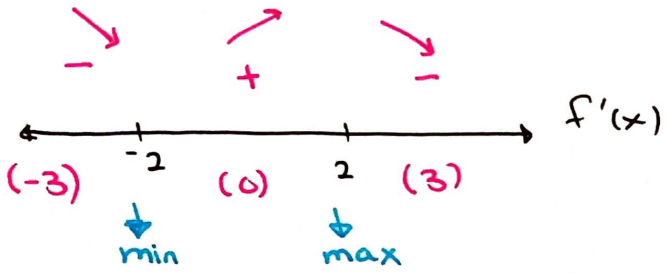
Problem 18: D

$$f'(x) = \frac{(x^2+4)(1) - x(2x)}{(x^2+4)^2} = \frac{x^2+4-2x^2}{(x^2+4)^2} = \frac{4-x^2}{(x^2+4)^2}$$

$4-x^2=0$ $\quad$ $(x^2+4)^2=0$

$x^2=4$ $\quad$ $x^2=-4$

$x=\pm 2$ $\quad$ NO SOL.



Problem 19

$$H(x) = f(g(2x))$$

$$H'(x) = f'(g(2x)) \cdot g'(2x) \cdot 2$$

$$H'(5) = f'(g(10)) \cdot g'(10) \cdot 2$$

$$= f'(0) \cdot (20)(2)$$

$$= (-4)(20)(2)$$

$$= -160$$

Problem 20:

$$G(x) = \sqrt{1 + f(x^2)}$$

$$G'(x) = \frac{1}{2\sqrt{1+f(x^2)}} \cdot f'(x^2) \cdot 2x$$

$$G'(3) = \frac{f'(9) \cdot (3)}{\sqrt{1+f(9)}} = \frac{(10)(3)}{\sqrt{1+3}} = 15$$

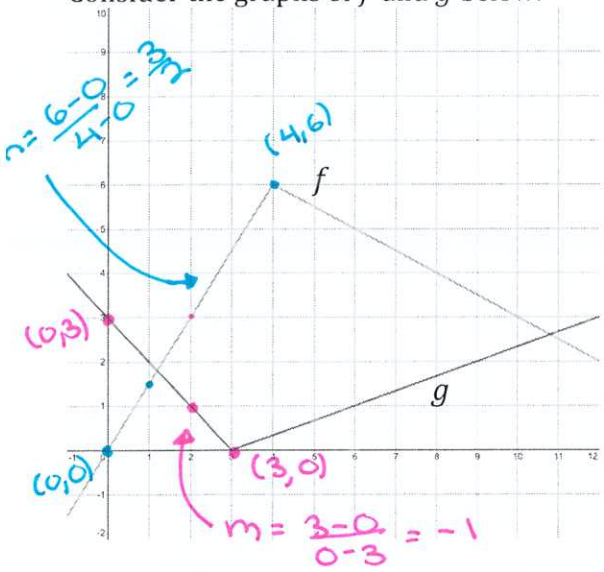
Problem 21:

$$(f^{-1})'(10) = \frac{1}{f'(f^{-1}(10))} = \frac{1}{f'(3)} = \frac{1}{20}$$

because $f(3) = 10$

Problem 22

Consider the graphs of f and g below.



$m = \frac{6-0}{4-0} = \frac{3}{2}$

$m = \frac{3-0}{0-3} = -1$

a) Let $u(x) = f(g(x))$, find $u'(2)$ if it exists. If it does not exist, state why.

$u'(x) = f'(g(x)) \cdot g'(x) \rightarrow u'(2) = f'(g(2)) \cdot g'(2)$

$f'(1) \cdot g'(2)$

$\left(\frac{3}{2}\right)(-1) = \boxed{-\frac{3}{2}}$

b) Let $v(x) = g(f(x))$, find $v'(2)$ if it exists. If it does not exist, state why.

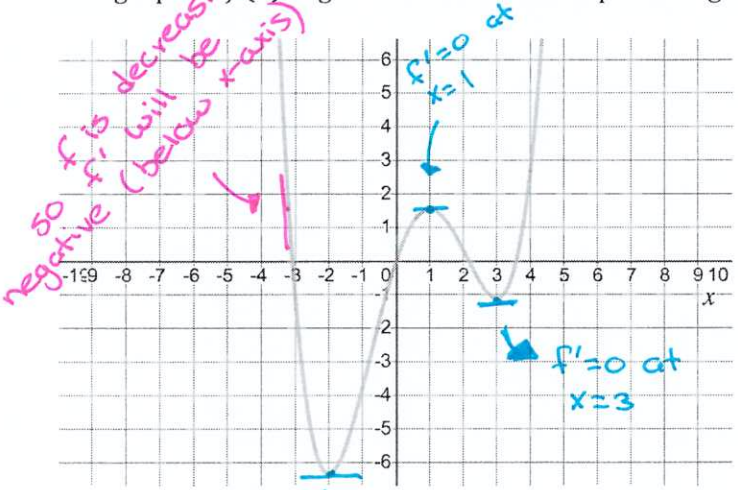
$v'(x) = g'(f(x)) \cdot f'(x) \rightarrow v'(2) = g'(f(2)) \cdot f'(2)$

$g'(3) \cdot f'(2)$

↳ DNE because of corner

Problem 23

The graph of $f(x)$ is given below. Sketch a possible graph of $f'(x)$.

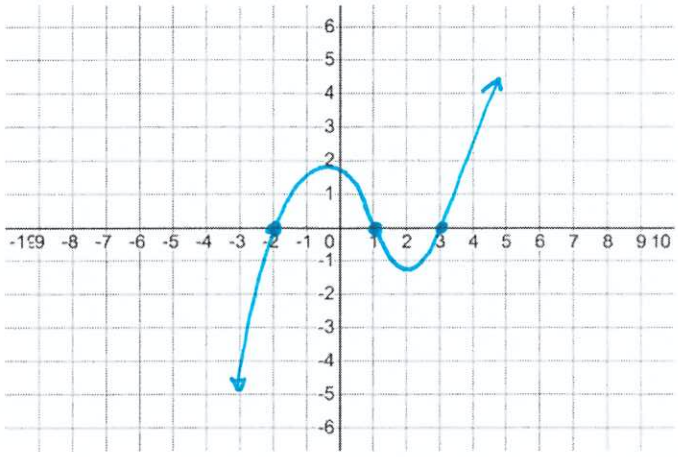


f is decreasing, so f' will be negative (below x-axis)

f'=0 at x=1

f'=0 at x=3

f'=0 at x=-2, so on the graph of f' it will hit the x-axis there



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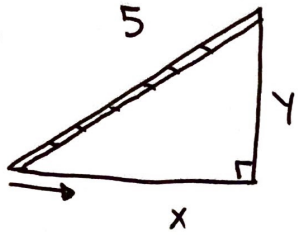
Problem 24

a)



$x^2 + y^2 = 25$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$2(3)\left(-\frac{1}{2}\right) + 2(4)\frac{dy}{dt} = 0$

$8\frac{dy}{dt} = 3$

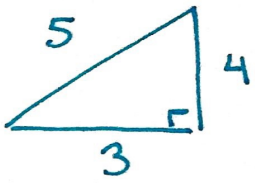
$\frac{dy}{dt} = \frac{3}{8}$ ft/s

$x = 3$

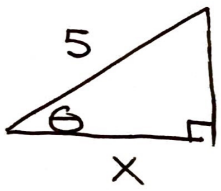
$y = 4$

$\frac{dx}{dt} = -0.5 = -\frac{1}{2}$

$\frac{dy}{dt} = ?$



b)



$\cos\theta = \frac{x}{5}$

$5\cos\theta = x$

$-5\sin\theta\frac{d\theta}{dt} = \frac{dx}{dt}$

$-5\left(\frac{4}{5}\right)\frac{d\theta}{dt} = -\frac{1}{2}$

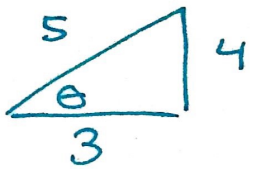
$\frac{d\theta}{dt} = \frac{1}{8}$ rad/s

$x = 3$

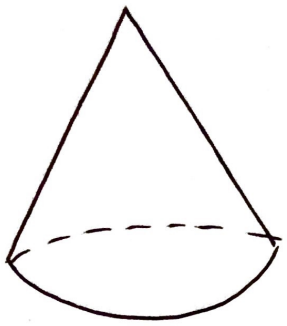
$\theta =$

$\frac{dx}{dt} = -\frac{1}{2}$

$\frac{d\theta}{dt} = ?$



Problem 25



$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi\left(\frac{3}{2}h\right)^2 h$

$V = \frac{1}{3}\cdot\frac{9}{4}\pi h^3$

$\frac{dV}{dt} = \frac{9}{4}\pi h^2 \frac{dh}{dt}$

$7 = \frac{9}{4}\pi(2)^2 \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{7}{9\pi}$ m/min

$V =$

$r =$

$h = 2$

$\frac{dV}{dt} = 7$

$\frac{dr}{dt} =$ → eliminate r

$\frac{dh}{dt} = ?$

$h = \frac{2r}{3}$

$3h = 2r$

$r = \frac{3h}{2}$