1. $f'(x) = 2\sec^2(x) + \frac{1}{1+(5x)^2} \cdot 5$

b). $f'(x) = \frac{1}{\sqrt{1-(x^2)^2}} \cdot 2x$

c. $f'(x) = x^3 \cdot \frac{1}{x^2+1} \cdot 2x + \ln(x^2+1)(3x^2)$

d. $f'(x) = \frac{(e^x + \sin(x))(2x + \sin x) - (x^2 - \cos(x))(e^x + \cos x)}{(e^x + \sin(x))^2}$

e) $f'(x) = \frac{1}{\sin(x^3+1)^{1/2}} \left(\cos(x^3+1)^{1/2}\right)\left(\frac{1}{2}\right)(x^3+1)^{-1/2}(3x^2)$

2. If f represents the oil reserves then f is increasing and $f' > 0$. Also, f' is decreasing, $f'' < 0$ and f is concave down. The rate of increase is decreasing

3. a) $-4, 1, 2, -2$

b) $-4, 2$

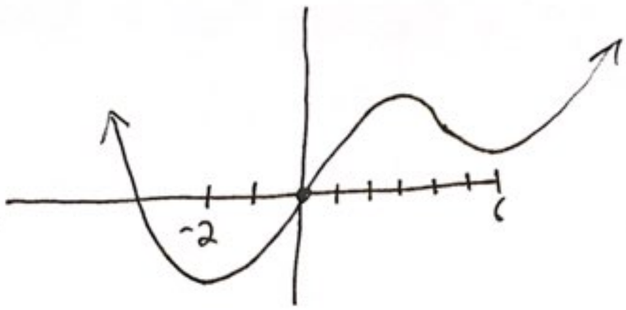
c) Yes at $x = 2$ b/c y-value is higher than all other y-values for the function

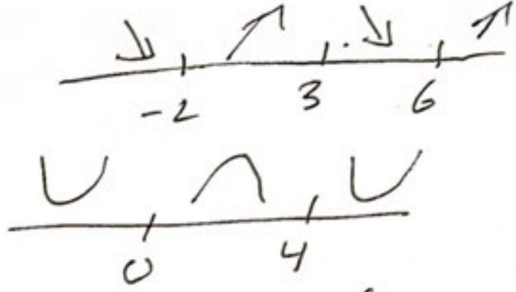
d) No both $\lim_{x \to \infty} f(x) = -\infty$ and $\lim_{x \to -\infty} f(x) = -\infty$

e) -4, -2

f.) Yes a continuous function on a closed interval must have a minimum. $x = -6$.

4.





5. At $x=2$ $y=8$. $(2,8)$ is a point on f.
$(8,2)$ is a point on f^{-1}. The slope of
$y=3x+2$ is $f'(2)$. $f'(2)=3$. $f^{-1}(8)$ is
The slope of f^{-1} at 8.

$$f(f^{-1}(x))=x \Rightarrow f'(f^{-1}(x))\cdot(f^{-1}(x))'=1$$

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

$$(f^{-1}(8))'=\frac{1}{f'(f^{-1}(8))}=\frac{1}{f'(2)}=\frac{1}{3}.$$

b) $y=\frac{1}{3}x+b$

$2=\frac{1}{3}(8)+b$ $\qquad \frac{6}{3}-\frac{8}{3}=b \quad -\frac{2}{3}=b$

$$y=\frac{1}{3}x-\frac{2}{3}.$$

6. a) $f'(x) = 5x^4 - 45x^2$

$0 = 5x^4 - 45x^2 \qquad 0 = 5x^2(x^2 - 9)$.

$0 = 5x^2(x-3)(x+3) \qquad x = 3, x = -3, x = 0$

b) $\nearrow \qquad \searrow \qquad \searrow \qquad \nearrow$

$f'(-10) = + \quad -3 \quad f'(-1) = - \quad 0 \quad f'(1) = - \quad 3 \quad f'(10) = +$

local min at $x = 3$

local max at $x = -3$

no extreme at $x = 0$.

c. $f(-4) = (-4)^5 - 15(-4)^3 = -64$

$f(-3) = (-3)^5 - 15(-3)^3 = 162$

$f(3) = 3^5 - 15(3)^3 = -162$

$f(4) = 4^5 - 15(4)^3 = 64$

$f(0) = 0^5 - 15(0)^3 = 0$

The maximum is 162.

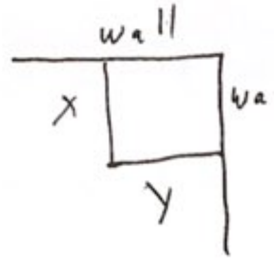
d. $f''(x) = 20x^3 - 90x = 10x(2x^2 - 9)$

$0 = 10x(2x^2 - 9) \qquad x = 0 \quad x = \pm\frac{3}{\sqrt{2}} \approx \pm 2.12$

$\frown \qquad \smile \qquad \frown \qquad \smile$

$f''(-10) = - \quad -\frac{3}{\sqrt{2}} \quad f'(-1) = + \quad 0 \quad f'(1) = - \quad \frac{3}{\sqrt{2}} \quad f'(10) = +$

inflection points $0, \pm\frac{3}{\sqrt{2}}$.

7. 

b) $A = xy$ $\quad 0 < x < 18$

$0 < y < 18$

C) $x + y = 18 \quad y = 18 - x \quad A = x(18 - x) = 18x - x^2$

$A' = 18 - 2x \quad 0 = 18 - 2x \quad 9 = x$

$\nearrow \quad \searrow$

$A'(1) = + \quad 9 \quad A'(10) = -$

$x = 9$ gives a maximum.

d) If she makes a square of side length 9 in

she has the maximum area of $81 in^2$

8. a) $1000(1.5) = \$1500$

b) $1.50 - 300(0.001) = 1.50 - .3 = 1.2$

$1300(1.2) = 1560$

c) $R = x(1.5 - (x - 1000)(.001)) = x(1.5 - (.001x - 1))$

$R = x(1.5 - .001x + 1) = x(2.5 - .001x) = 2.5x - .001x^2$

$1000 \leq x \leq 2000$

$R'(x) = 2.5 - .002x \quad 0 = 2.5 - .002x \quad x = 1250$

$R(1000) = 1500$

$R(1250) = 1562.5$

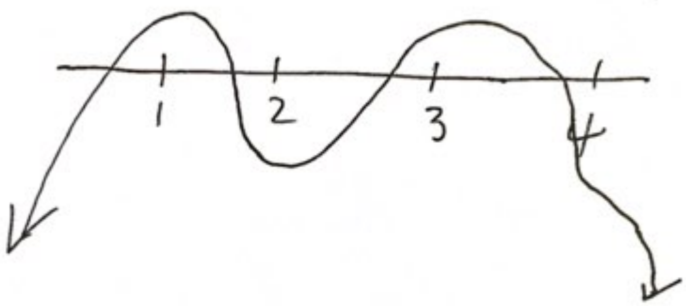
$R(2000) = 1000$

NOT required in this question but in case you're interested.

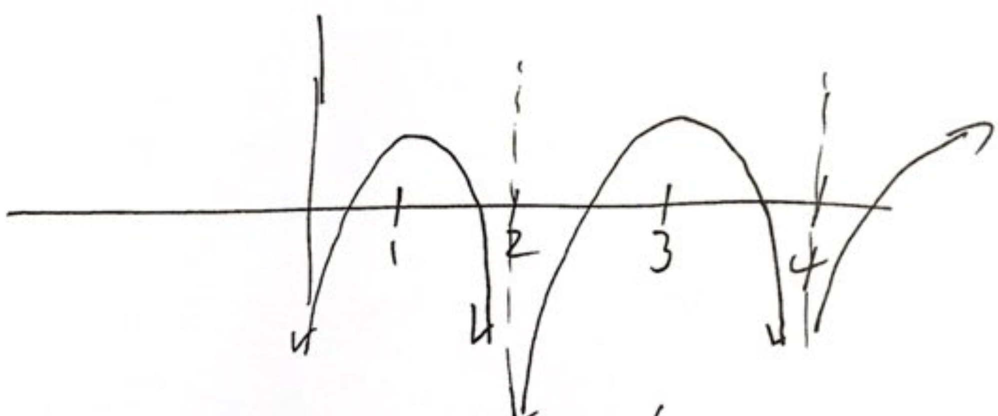
max of 1562.5 at

$x = 1250$.

9. If is a continuous function then 2 must be a min but 4 may not be.



If f is not continuous then both f and f' may be undefined at 2 & 4.



Neither 2 nor 4 has to be a min.