Panel 1

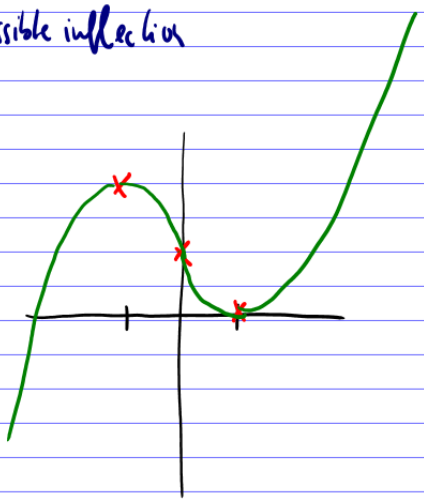
Graph $y = x^3 - 3x + 2$

$y' = 3x^2 - 3 = 0$

$3(x^2 - 1) = 0 \Rightarrow x = \pm 1$ critical pts

$y'' = 6x = 0 \Rightarrow x = 0$ possible inflection

	-1	0	
f'	+	−	−	+
f''	−	−	+	+
f	∩		∪	



$f(0) = 2$

$f(1) = 0$

$f(-1) = 4$

1

Panel 2

$\int e^x - x^2 - 5\,dx = e^x - \frac{1}{3}x^3 - 5x + C$

$f'(x) = \sqrt{x} - 3$, $f(4) = -1$

$f(x) = \int \sqrt{x} - 3\,dx = \int x^{1/2} - 3\,dx = \frac{2}{3}x^{3/2} - 3x + C$

$-1 = f(4) = \frac{2}{3}(4)^{3/2} - 12 + C$

$-1 = \frac{16}{3} - 12 + C =$

$-1 = -\frac{20}{3} + C$

$-1 + \frac{20}{3} = C$

$\frac{17}{3} = C$

$f(x) = \frac{2}{3}x^{3/2} - 3x + \frac{17}{3}$

2

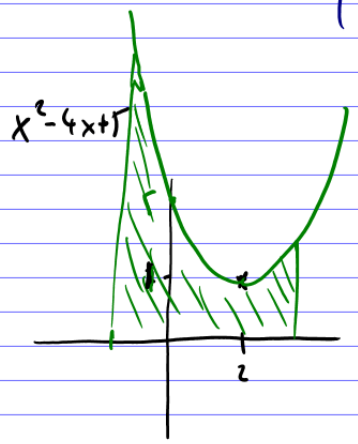
Panel 3

Find the area under the curve $y = x^2 - 4x + 5$ from x=-1 to x=3. Sketch the region.

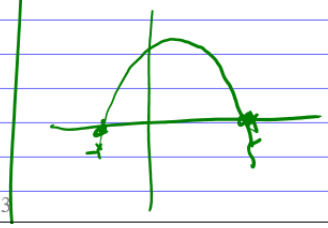
$$A = \int_{-1}^{3} x^2 - 4x + 5 \, dx = \frac{1}{3}x^3 - \frac{4}{2}x^2 + 5x \Big|_{-1}^{3}$$

$$(9 - 18 + 15) - \left(-\frac{1}{3} - 2 - 5\right)$$

$$13 = 40/3$$



$y = -(x^2 - 4x - 5) = -(x-5)(x+1) =$



3

Panel 4

1. If $R(x) = 60x - .3x^2$ and $C(x) = 12x + 2$, find the maximum profit and the number of units that must be produced and sold to maximize the profit.

$P(x) = R(x) - C(x) =$

$= 60x - 0.3x^2 - 12x - 2 = 48x - 0.3x^2 - 2$.

11. Suppose $8000 is invested in an account. How much money is in the account in 6 years if the interest rate is 5% compounded: a) monthly b) continuously?

$P'(x) = 48 - 0.6x = 0$, $x = \frac{48}{0.6} = 80$ # of units for max profit

of $P(80)$

$R(q) = p(q) \cdot q$

$R(q)$ related to price and quantity: $R(\ ) = p \cdot q$ $R(p) = p \cdot q(p)$

4

Panel 5

11. Suppose $8000 is invested in an account. How much money is in the account in 6 years if the interest rate is 5% compounded: a) monthly b) continuously?

a) $A = P(1+r)^n = 8000\left(1+\frac{0.05}{12}\right)^{6\cdot 12}$

b) $A = Pe^{r\cdot t}$, $A = 8000e^{0.05\cdot 6}$ cont. compounded formula

5

Panel 6

2. An object is dropped from a certain height. It is known that it will fall a distance of $s(t) = 16t^2$ where s is in feet and t is in seconds. What is the average speed from 3 to 5 seconds.

rate of change

$\text{avg. speed} = \frac{s(5)-s(3)}{5-3} = \frac{16\cdot 25 - 16\cdot 9}{2} = \frac{16(25-9)}{2} = 8\cdot 16 = 128$

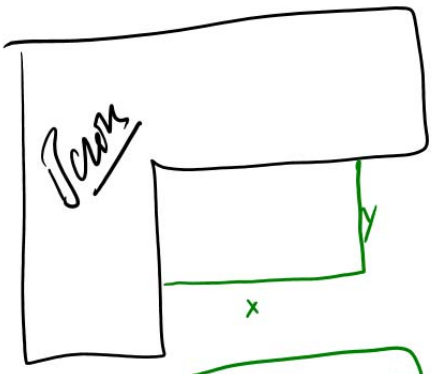
(inst) rate of change $= f'$, $f'(4) = 32t$

velocity at $t=4$: $f'(4) = 32t\big|_{t=4} = 128$

6

Panel 7

A rancher has 50 feet of fencing to fence off a rectangular animal pen in the corner of a barn. The corner of the barn will not be fenced. What dimensions of the rectangle will maximize the area?



$x+y=50$, $y=50-x$

$A=xy$ max!

$A=x(50-x)=50x-x^2$

$A'(x)=50-2x=0$ $x=25$

$x=25, y=25$

Parabola going down → max

7

Panel 8

14. After t hours of operation, a coal mine is producing coal at a rate of $40+2t-9t^2$ tons of coal per hour. Find the formula for the output of the coal mine after t hours of operation if we know that after 2 hours, 80 tons have been mined.

15. A firm estimates that it will sell N units of a product after spending x dollars on advertising, where $N(x)=-x^2+300x+6$ and x is measured in thousands of dollars. What is the rate of change of the number of units sold with respect to the amount spent on advertising after spending $10 thousand?

#14: $f'(t)=40+2t-9t^2 \Rightarrow f(t)=\int 40+2t-9t^2\,dx=$

$=40t+t^2-3t^3+C$

To find C: use $f(2)=80=80+4-3\cdot 8+C=$

$=80+4-24+C=$

$80=60+C \Rightarrow C=20$

#15 $N'(x)$ at $x=10$, $N'(x)=-2x+300 \Rightarrow N'(10)=280$

8

Panel 9