Week 1
MATH 34B
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1.5 Solve for x: $\frac{x+4}{8x-1} = \frac{x+8}{8x-7}$

$$(x+4)(8x-7) = (x+8)(8x-1)$$

$$8x^2 + 32x - 7x - 28 = 8x^2 + 64x - x - 8$$

$$25x - 28 = 63x - 8$$

$$-20 = 38x$$

$$x = \frac{-20}{38}$$

1.10 What is the equation of the line going through the two points $(2,8)$ and $(3,2)$?

$$y - y_1 = m(x - x_1) \qquad \text{To find } m: \quad m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-2}{2-3} = -6$$

$$y - 8 = -6(x-2)$$

$$\Rightarrow y = -6x + 20$$

1.12 The perimeter of a rectangle is $26cm$. If the area of the rectangle is $40cm^2$ find the length and width of the rectangle (assume length is smaller than the width).

$$A = \text{area} \quad l \cdot w = 40 \implies l = \frac{40}{w}$$

$$P = 2l + 2w = 26.$$

$$2l + w = 13.$$

$$\frac{40}{w} + w = 13$$

$$40 + w^2 - 13w = 0.$$

$$w^2 - 13w + 40 = 0.$$

$$w^2 - 13w + 40 = 0$$

$$(w-5)(w-8) = 0$$

$$\implies w = 5 \text{ or } 8,$$

If $w = 5$, $l = 8$

$\boxed{\text{If } w = 8, l = 5}$ ← since $l < w$!!

2.2 Solve for a: $\int_1^a 2dx = 12$.

$$\int_1^a 2 \, dx = 2x \Big|_1^a = 2a - 2$$

$$2a - 2 = 12 \implies a = 7.$$

2.8 Maximize: $f(x) = 1 + 4x - x^2$.

$$f'(x) = 4 - 2x$$

$$f'(x) = 0 \Rightarrow 4 - 2x = 0 \Rightarrow 4 = 2x \Rightarrow x = 2.$$

To see max at $x = 2$, notice $f''(x) = -2 < 0$.

So, $f(2) = 1 + 4(2) - (2)^2 = 5$ is max

2.9 Where is $f(x) = x^2 - 5x$ increasing?

$$f'(x) = 2x - 5$$

f increasing $\iff f'(x) > 0$.

$$2x - 5 > 0 \Rightarrow x > +5/2.$$

So, f increasing when $x > +5/2$.

2.10 Find the second derivative of $8x^3 + 2x$.

$$f'(x) = 3 \cdot 8x^2 + 2$$
$$= 24x^2 + 2$$
$$f''(x) = 48x$$

2.13 The total number of people at a football game was 5600. Field-side tickets were 40 dollars and end-zone tickets were 20 dollars. If the total amount of money received for the tickets was 186000 how many of each kind of ticket were sold.

Let a = field side tickets, b = end-zone tickets,

$$a + b = 5600. \Rightarrow b = 5600 - a.$$

$$40a + 20b = 186000.$$

$$40a + 20(5600 - a) = 186000$$
$$\Rightarrow a = 3700$$
$$\Rightarrow b = 1900$$