Find the function of the line passing through points (1,25) and (4, 40).

$$(1, 25) \text{ and } (4, 40)$$

$$m = \frac{40 - 25}{4 - 1} = \frac{15}{3} = 5$$

$$b = 25 - (5)(1) = 25 - 5 = 20$$

$$y = 5x + 20$$

Find the exponential model that passes through points (-1,2) and (3,1).
Round to four decimal places.

$$(-1, 2) \text{ and } (3, 1)$$

$$f(x) = Ab^x$$

$$2 = Ab^{-1}$$

$$1 = Ab^3$$

$$\frac{1}{2} = \frac{Ab^3}{Ab^{-1}}$$

$$0.5 = b^{3-(-1)}$$

$$0.5 = b^4$$

$$b = (0.5)^{1/4} = 0.8409$$

now find A

$$1 = A(0.8409)^3$$

$$A = \frac{1}{(0.8409)^3} = 1.6818$$

$$f(x) = 1.6818(0.8409^x)$$

Given the table below, write the function in equation form.

x	-2	-1	0	1	2
f(x)	5/6	5/3	10/3	20/3	40/3

As x increases by 1, f(x) is multiplied by 2 so exponential with b=2.

When x=0, f(x)=10/3=A

$$f(x)=\left(\frac{10}{3}\right)2^x$$

Given the table below, write the function in equation form.

x	-2	0	2	4	6
f(x)	-9	-7	-5	-3	-1

As x increases by 2, f(x) increased by 2 so linear with m=2/2=1

when x=0, f(x)=-7=b

$$y = x - 7$$

A company can produce 100 bicycles in a day at a total cost of $10,500 and it can produce 120 bicycles in a day at a total cost of $11,000.

Write the linear cost function.

What is the daily fixed cost?

$$(100, 10{,}500) \text{ and } (120, 11{,}000)$$

$$m = \frac{11000 - 10500}{120 - 100} = \frac{500}{20} = 25$$

$$b = 10500 - (25)(100) = 8000$$

$$f(x) = 25x + 8000$$

Fixed costs are $8000 per day.

At a price of $2.50, the supply of corn is 8.5 million bushels, and at a price of $3.30 the supply of corn is 10.5 million bushels.

At the price of $2.50, the demand for corn is 9.8 million bushels, and at a price of $3.30 the demand for corn is 7.8 million bushels.

Find the supply and demand equations.
Give the equilibrium price.

$$\text{supply: } (2.50, 8.5) \text{ and } (3.30, 10.5)$$

$$m = \frac{10.5 - 8.5}{3.3 - 2.5} = \frac{2}{0.8} = 2.5$$

$$b = 8.5 - (2.5)(2.50) = 2.25$$

$$q(p) = 2.5p + 2.25$$

$$\text{demand: } (2.50, 9.8) \text{ and } (3.30, 7.8)$$

$$m = \frac{7.8 - 9.8}{3.3 - 2.5} = \frac{-2}{0.8} = -2.5$$

$$b = 9.8 - (-2.5)(2.50) = 16.05$$

$$q(p) = -2.5p + 16.05$$

$$equilib: -2.5p + 16.05 = 2.5p + 2.25$$

$$13.8 = 5p$$

$$\$2.76 = p$$

A desk manufacturer has operating costs of $360 a week plus $40 per desk. The manufacturer is able to sell the desks for $60 each. How many desks does the manufacturer need to sell to breakeven?

Let x = # desks

$$C(x) = 40x + 360$$

$$R(x) = 60x$$

$$P(x) = R(x) - C(x) = 60x - (40x + 360)$$

$$= 20x - 360$$

breakeven :

$$P(x) = 20x - 360 = 0$$

$$x = \frac{360}{20} = 18 \text{ desks}$$

A radio manufacturer has fixed costs of $160 plus $10 for each radio. The demand for the radios is given by $q = -1.25x + 50$

Write the cost, revenue, and profit as functions of x and determine the selling price of the radios that maximize profit.

$$q = -1.25x + 50$$

$$C(q) = 10q + 160$$

$$C(x) = 10(-1.25x + 50) + 160 = -12.5x + 660$$

$$R(x) = xq = x(-1.25x + 50) = -1.25x^2 + 50x$$

$$P(x) = R(x) - C(x) = -1.25x^2 + 50x - (-12.5x + 660)$$

$$= -1.25x^2 + 62.5x - 660$$

$$\text{max profit when } x = \frac{-62.5}{2(-1.25)} = \$25$$

A surfboard company has fixed costs of $200 per day plus $180 per board. Write the linear cost function.

How much does the 7^{th} board cost?

How much does is cost to make 10 boards?

$$C(x) = 180x + 200$$

7th board cost = marginal cost = slope = \$180

10 boards cost:

$$C(10) = 180(10) + 200 = 1800 + 200 = \$2000$$

The average weight of a sedan could be approximated by

$$W = 6t^2 - 240t + 4800 \qquad (5 \le t \le 27)$$

where t is the year of manufacture since 1970 and W is the average weight in pounds.

In which year were the sedans the lightest? What was their average weight in that year?

$$W = 6t^2 - 240t + 4800 \quad (5 \le t \le 27)$$

parabola opening down so

min weight occurs at vertex

$$t = \frac{-(-240)}{2(6)} = 20 \text{ so in } 1990$$

$$W(20) = 6(20^2) - 240(20) + 4800 = 2400 \text{ pounds}$$

Numerically estimate the limit

$$\lim_{x \to 2} \frac{x+3}{x}$$

x	1.9	1.99	1.999	2	2.001	2.01	2.1
f(x)	2.45	2.495	2.4995		2.5005	2.505	2.55

From the table,

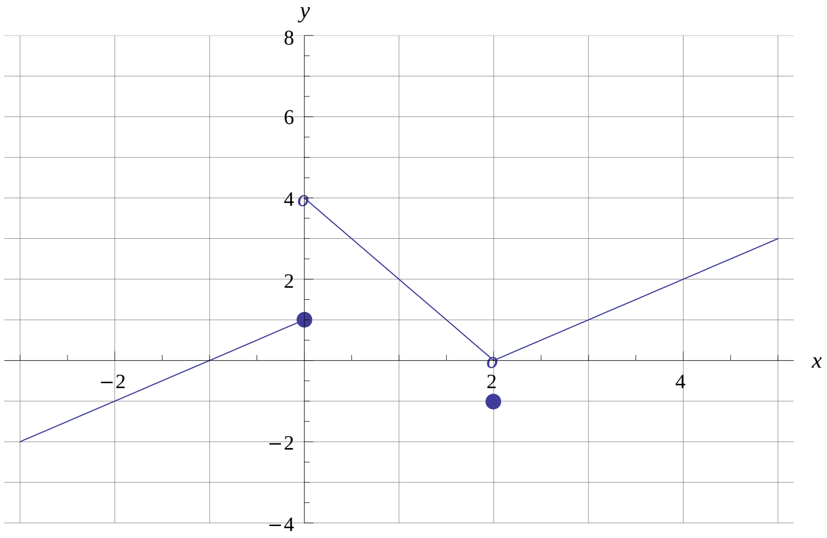
$$\lim_{x\to 2^-} \frac{x+3}{x} = 2.5$$

$$\lim_{x\to 2^+} \frac{x+3}{x} = 2.5$$

so

$$\lim_{x\to 2} \frac{x+3}{x} = 2.5$$

Use the graph to estimate the following



$$\lim_{x \to 2} f(x)$$

$$\lim_{x \to 0^-} f(x)$$

$$\lim_{x \to 0^+} f(x)$$

$$f(2)$$

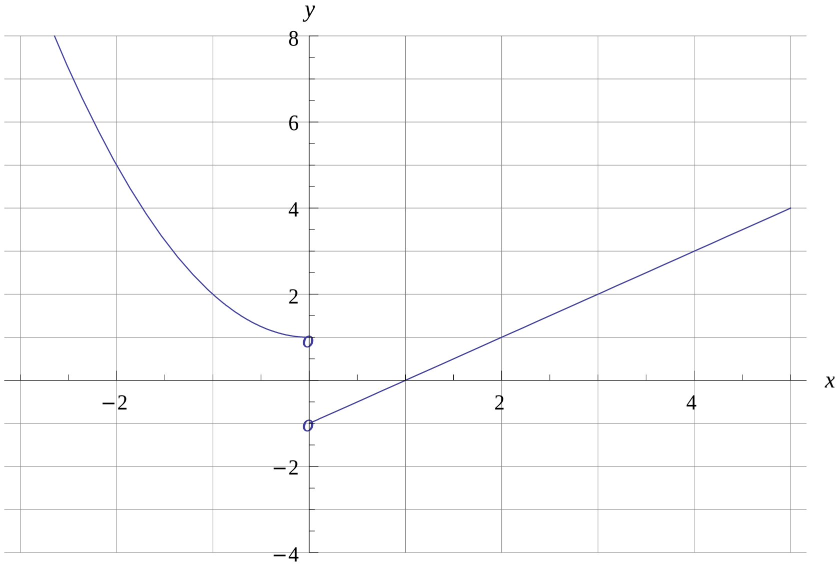
$$\lim_{x\to 2} f(x) = 0$$

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

$$\lim_{x\to 0^+} f(x) = 4$$

$$f(2) = -1$$

Answer the questions about the graph of f(x).



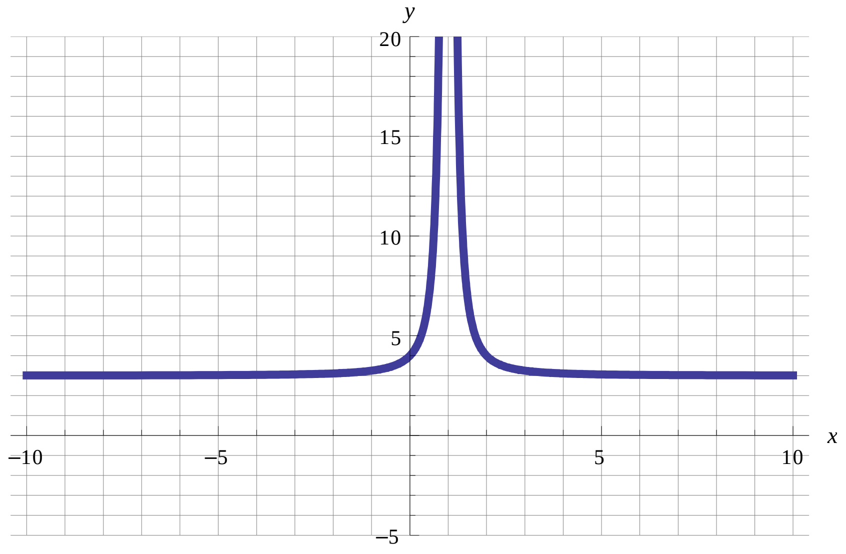
1. what is the domain?
2. when is $f(x) \leq 2$?

$$\text{domain: } (-\infty, 0) \cup (0, \infty)$$

$$f(x) \leq 2: \quad [-1, 0) \cup (0, 3]$$

Is the graph continuous?

Is the graph cont on its domain?



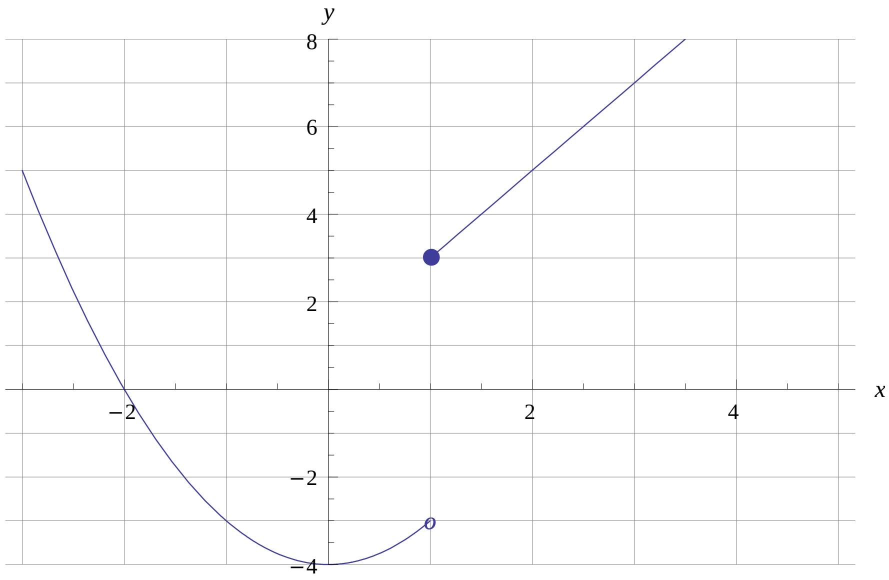
The graph is not continuous because there is a vertical asymptote at x=1.

The domain is $(-\infty,1)\cup(1,\infty)$
The graph is cont on its domain.

Sketch the graph of the function.

$$f(x) = \begin{cases} x^2 - 4 & \text{if } x < 1 \\ 2x + 1 & \text{if } x \geq 1 \end{cases}$$

$$f(x)=\begin{cases} x^2-4 & \text{if } x<1 \\ 2x+1 & \text{if } x\geq 1 \end{cases}$$



If you invest $5000 compounded continuously at a rate of 6.3% interest. How much will you have after 12 years?

$$A = Pe^{rt}$$

$$A = 5000e^{0.063t}$$

$$A(12) = 5000e^{0.063(12)} = \$10,648.70$$

How long will it take an investment to double is compounded continuously at 8.5 % interest?

$$A = Pe^{rt}$$

$$A = Pe^{0.085t}$$

$$2P = Pe^{0.085t}$$

$$2 = e^{0.085t}$$

$$\ln(2) = 0.085t$$

$$t = \frac{\ln(2)}{0.085} = 8.15 \text{ years}$$

How long will it take \$2000 to grow to \$5000 if invested at 7% interest compounded quarterly?

$$A = P\left(1+\frac{r}{m}\right)^{mt}$$

$$A = 2000\left(1+\frac{0.07}{4}\right)^{4t} = 2000(1.0175)^{4t}$$

$$5000 = 2000(1.0175)^{4t}$$

$$2.5 = (1.0175)^{4t}$$

$$\ln(2.5) = \ln(1.0175)^{4t}$$

$$\ln(2.5) = 4t\ln(1.0175)$$

$$t = \frac{\ln(2.5)}{4\ln(1.0175)} = 13.2 \text{ years}$$

Find the exponential model given that
a bacteria culture starts with 1000 bacteria
and two hours later has 1500 bacteria.
Round to four decimal places.

Use the model to predict how many
bacteria will be there after 4 hours.

$$f(x) = Ab^x$$

$$(0,1000), (2,1500)$$

$$f(0) = Ab^0 = 1000 \Rightarrow A = 1000$$

$$f(x) = 1000b^x$$

$$f(2) = 1000b^2 = 1500$$

$$b^2 = 1.5$$

$$b = \sqrt{1.5} = 1.2247$$

$$f(x) = 1000(1.2247^x)$$

$$f(4) = 1000(1.2247^4) = 2249.67 \approx 2250 \text{ bacteria}$$

Write the exponential decay model Q(t) given that

$Q = 1000$ when $t = 0$ and the half life is 1.5 years

Round to four decimal places.

$Q = 1000$ when $t = 0$ and the half life is 1.5 years

$$Q(t) = Q_0 e^{-kt}$$

$Q = 1000$ when $t = 0 \;\Rightarrow\; Q_0 = 1000$

$$Q(t) = 1000e^{-kt}$$

$$500 = 1000e^{-k(1.5)}$$

$$0.5 = e^{-k(1.5)}$$

$$\ln(0.5) = -k(1.5)$$

$$k = \frac{\ln(0.5)}{-1.5} = 0.4621$$

$$Q(t) = 1000e^{-0.4621t}$$

Find all points of discontinuity.
Justify your answer using limits.

$$f(x) = \begin{cases} x+2 & \text{if } x < -1 \\ -x^2+4 & \text{if } -1 \le x \le 0 \end{cases}$$

Each piece is in closed form so continuous over given *x*-values, so check connecting places.

$x = -1:$

$$\lim_{x \to -1^-} f(x) = \lim_{x \to -1^-} (x+2) = -1+2 = 1$$

$$\lim_{x \to -1^+} f(x) = \lim_{x \to -1^+} (-x^2+4) = -(-1)^2+4 = 3$$

$$\Rightarrow \lim_{x \to -1} f(x) \ \ dne \ \ \text{because} \ \ \lim_{x \to -1^-} f(x) \neq \lim_{x \to -1^+} f(x)$$

$f(x)$ is discont at $x = -1$

Evaluate the limit.

$$\lim_{x \to 5} \frac{x^2 - 4x - 5}{x - 5}$$

First try substituting $x = 5$.

We get $\lim_{x \to 5} \frac{x^2 - 4x - 5}{x - 5} = \frac{0}{0}$

Factor

$$\lim_{x \to 5} \frac{x^2 - 4x - 5}{x - 5} = \lim_{x \to 5} \frac{(x-5)(x+1)}{(x-5)} = \lim_{x \to 5}(x+1) = 5 + 1 = 6$$

Find the horizontal asymptote of

$$f(x) = \frac{x^3 - 2x + 4}{-2x^3 + 9x^2 - 1}$$

$$f(x) = \frac{x^3 - 2x + 4}{-2x^3 + 9x^2 - 1}$$

$$\lim_{x \to \infty} f(x) = \lim_{x \to \infty} \frac{x^3 - 2x + 4}{-2x^3 + 9x^2 - 1} = \lim_{x \to \infty} \frac{x^3}{-2x^3} = \lim_{x \to \infty} \frac{1}{-2} = \frac{1}{-2}$$

HA: $y = -\frac{1}{2}$

Evaluate the limit

$$\lim_{x \to -2} \frac{2x^2 - 5x + 2}{x^2 + 3x}$$

First try to substitute $x = -2$.

$$\lim_{x \to -2} \frac{2x^2 - 5x + 2}{x^2 + 3x} = \frac{2(-2)^2 - 5(-2) + 2}{(-2)^2 + 3(-2)} = \frac{20}{-2} = -10$$

Evaluate the limit.

$$\lim_{x \to -1} \frac{4}{x+1}$$

First try substituting $x = -1$.

$$\lim_{x \to -1} \frac{4}{x+1} = \frac{4}{0}$$

$$\lim_{x \to -1^-} \frac{4}{x+1} = \frac{+}{-} = -\infty$$

as $x \to -1^-, \quad x+1 < 0$

$$\lim_{x \to -1^+} \frac{4}{x+1} = \frac{+}{+} = +\infty$$

as $x \to -1^+, \quad x+1 > 0$

$\Rightarrow \quad \lim_{x \to -1} \frac{4}{x+1}$ dne