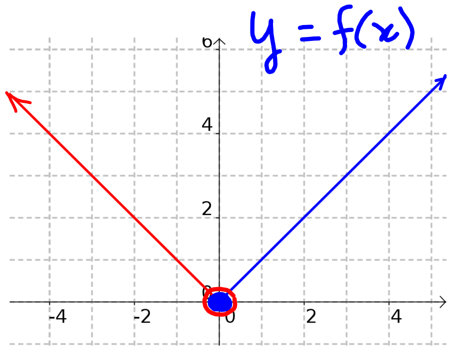
Piecewise Functions

Some functions are represented by two or more pieces.
For example, the absolute value function:

$$f(x) = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$



Notice that intervals are mutually exclusive (i.e., they don't overlap).

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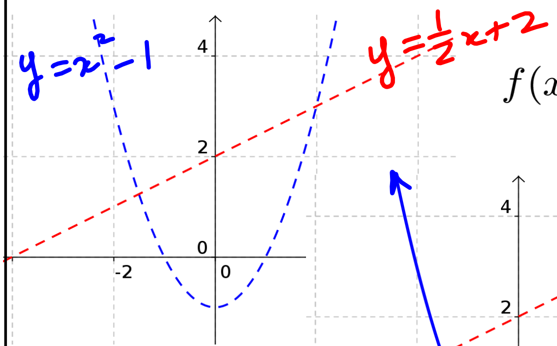
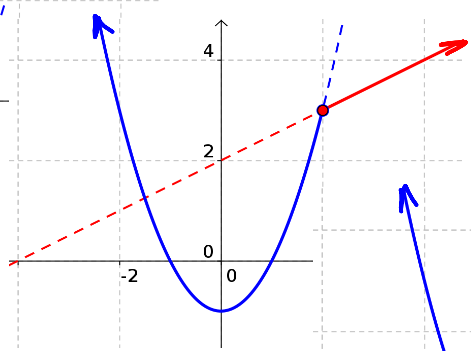
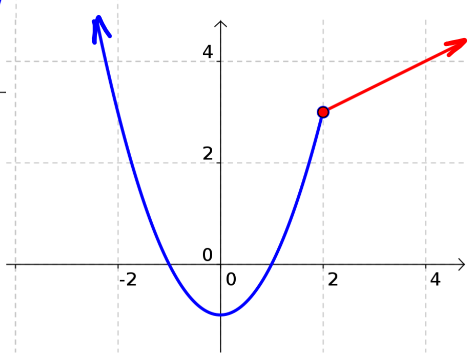
To represent a piecewise function, you may wish to fully sketch or graph each piece (dotted lines), and then emphasize or remove sections according to the intervals for each piece.



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





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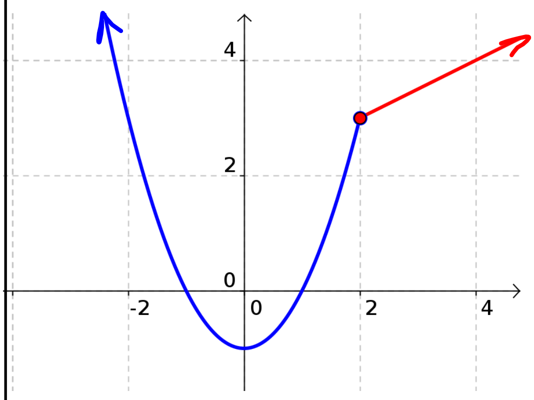
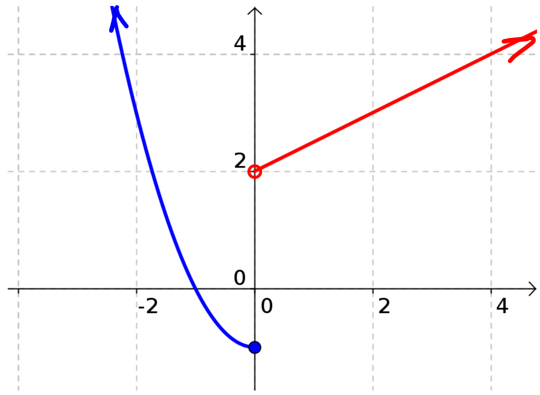
The intervals for each piece can have a significant impact on the overall function, including continuity or any discontinuities.





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

$$f(x) = \begin{cases} x^2 - 1, & x \leq 0 \\ \frac{1}{2}x + 2, & x > 0 \end{cases}$$

continuous function

jump discontinuity at x = 0

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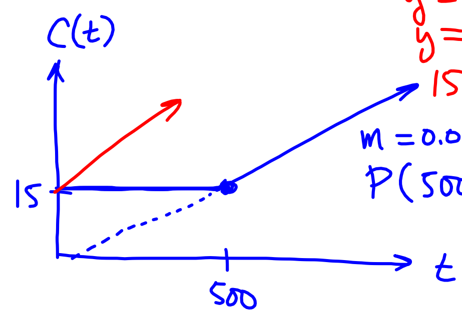
Assigned Work:

p.51 # 3, 4, 5cd, 6, 8, 9, 11, 13

6.



$y = mx + b$

$y = 0.02x + b$

$15 = 0.02(500) + b$

$m = 0.02$

$P(500, 15)$

$b = 5$

$$C(t) = \begin{cases} 15, & 0 \leq x \leq 500 \\ 0.02x + 5, & x > 500 \end{cases}$$

$\cancel{y = 0.02x + 15}$

$y = 0.02(x - 500) + 15$

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8. $f(x) = \begin{cases} x^2 - k, & x < -1 \\ 2x - 1, & x \geq -1 \end{cases}$

only jump possible at $x = -1$

$y = x^2 - k$ for $x = -1$

$y = (-1)^2 - k$

$= 1 - k$

$y = 2x - 1$ for $x = -1$

$= 2(-1) - 1$

$= -3$

for continuity (i.e., no jump)

$1 - k = -3$

$4 = k$

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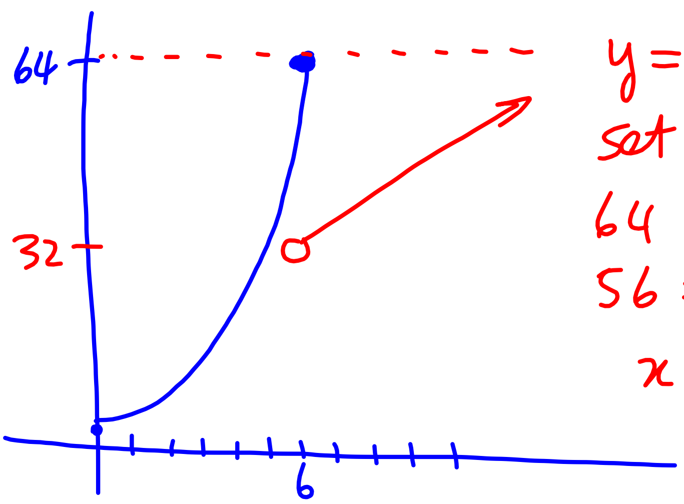
9. $f(x) = \begin{cases} 2^x, & 0 \leq x \leq 6 \\ 4x + 8, & x > 6 \end{cases}$



$y = 4x + 8$

set $y = 64$

$64 = 4x + 8$

$56 = 4x$

$x = 14$

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