

# Investigation - Functions

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## 1 Class work

1. State the domain and range of each of the following functions, you may use technology to aid your answers.

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

2. The previous functions are all radical functions. Using the tool of your preference [Desmos](#) or [Geogebra](#), investigate the graphs of a generic radical function of the form  $y = a\sqrt{x - b} + c$ , and make sure you have sliders for each coefficient  $a, b$  and  $c$ . Make a note of its characteristics based on your observations. Consider the following: How do you determine their domain? How do you determine their range? What factors can alter their concavity (concave up or concave down)?
3. Draw a sketch of the following functions. Remember to label clearly important features: x and y intercepts, vertical and horizontal asymptotes, etc. Your sketch should meet the following requirements: Clear window and scales set for the horizontal and vertical axes and present them appropriately labeled, one soft and continuous curve going through any of the points mentioned earlier, your graph should show appropriate end behaviour (asymptotic, increasing, decreasing, etc.) and symmetry, where applicable. Write down clearly their domain and range.

- $y = -2x - 3$
- $y = \frac{3}{2}x^2 - 2x - 2$
- $y = \frac{2x-1}{x^2-4}$

- $y = \frac{3x-5}{4x+5}$
- $y = \frac{2x^2+5x+2}{x-3}$
- $y = \frac{x^2+5x-14}{x^2-9}$
- $y = \sqrt{x+3} - 1$
- $y = -2\sqrt{x-1} - 2$

4. Consider the following graphs of piece-wise functions and write down their domain and their range. To join multiple sets of values use the union symbol,  $\cup$ . in the example below: Domain is  $x > -1$  and range is  $y \geq 2$ .

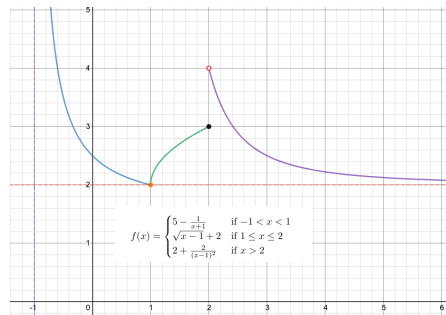
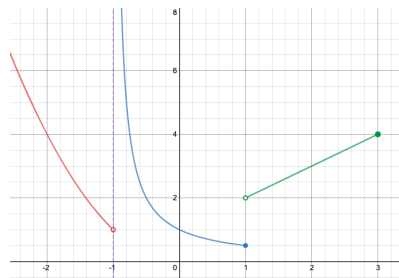
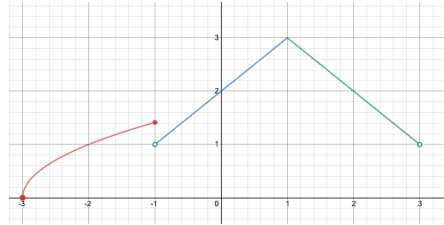


Figure 1: Example

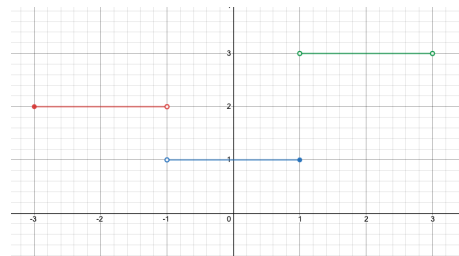
- $f(x)$



- $g(x)$



- $h(x)$



5. A piece-wise function is a function that is defined by sections over their domain. Each section in a piece-wise function can have completely different behaviour. The sections can be connected (continuous) or disconnected (discontinuous). Draw a sketch of the following functions and write down clearly their domain and range.

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$$f(x) = \begin{cases} -x & \text{if } -3 \leq x < 0 \\ (x-1)^2 + 1 & \text{if } 0 \leq x < 2 \end{cases}$$

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$$f(x) = \begin{cases} \sqrt{x+2} & \text{if } -3 \leq x < -1 \\ -x^2 + 2 & \text{if } -1 \leq x < 1 \\ (x-2)^2 & \text{if } 1 < x < 3 \end{cases}$$

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$$f(x) = \begin{cases} -\frac{1}{x} & \text{if } x \leq -\frac{1}{2} \\ \sqrt{x} + 2 & \text{if } 0 \leq x < 4 \\ -2x + 12 & \text{if } 4 \leq x < 6 \end{cases}$$

## 2 Homework

6. Using the tool of your preference [Desmos](#) or [Geogebra](#), investigate how to graph piece-wise functions. Each program will have different instructions,

so choose to work with the one you feel most comfortable with. Hence, practice graphing a few piece-wise functions.

7. It's time to get creative. Using the knowledge of functions you already have (linear, quadratic, rational, radical and piece-wise functions) and your skills using Geogebra and/or Desmos, create an original picture in the style of the graph shown in Investigation 5 on page 83, from the Mathematics Analysis and Approaches textbook (Oxford). Submit your work [here](#).