Piecewise Functions → function that's in pieces

1. Some relationships in real life cannot be represented by one single function. You can define a relationship using different pieces/functions. Can you make up a real life problem where cost of something changes with time? Write out the problem and show an example of algebraic and graphical model for it.

2. Sketch each of the following piecewise graphs.

a. eg.

$x=2,\ y=2+1=3$ (2,3) point

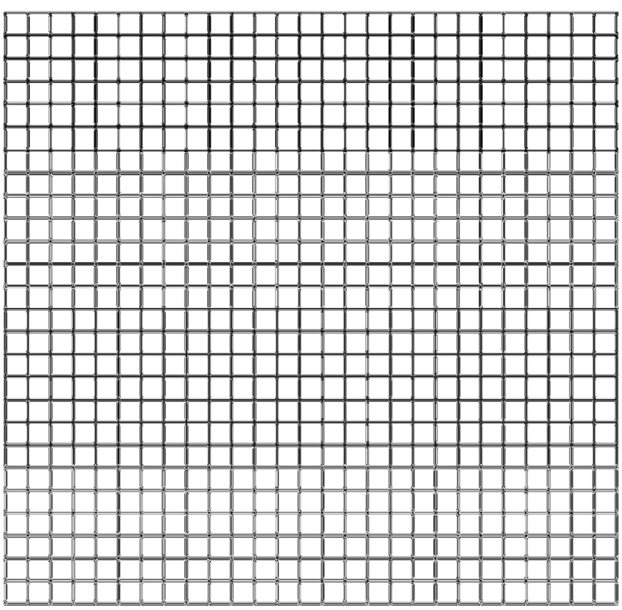
included

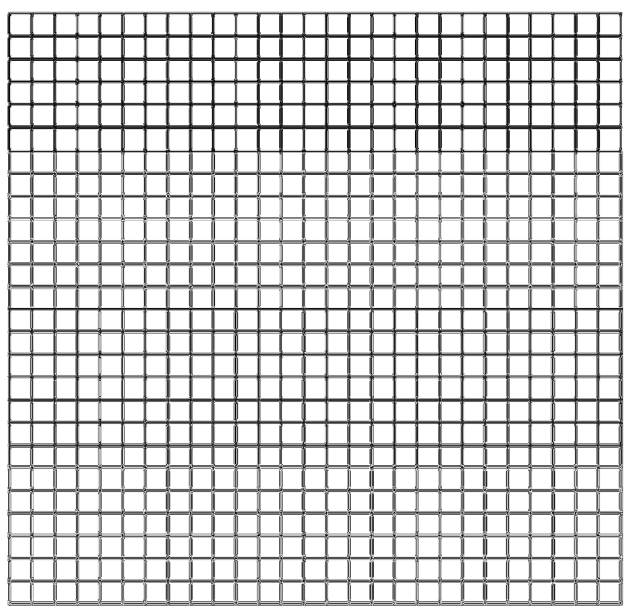
$$f(x)=\begin{cases} x+1 & x\le 2 \\ (x-3)^2+1 & 2<x\le 6 \\ -\frac{1}{2}x+5 & 6<x \end{cases}$$

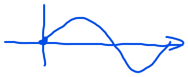
not included

b.

$$f(x)=\begin{cases} -3+\sqrt{-x} & -9<x<-4 \\ -1 & x=-4 \\ x^2+4x+3 & -4<x\le -1 \\ 2^x & 0<x \end{cases}$$







① How many functions
② what functions are they?
③ Identify the equation of each functions.
④ identify the interval.

3. Give an algebraic representation for each of the following graphs.

a.

eg. $y = a\sin[k(x-d)] + c$ $\therefore y = 2\sin x + 3$

$a = \frac{max - min}{2} = 2$

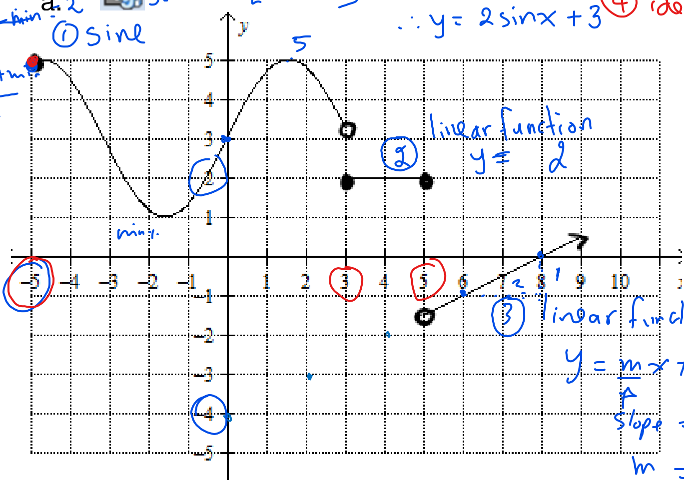
$c = \frac{max + min}{2} = 3$

$k = \frac{2\pi}{p}$

$k = \frac{2\pi}{2\pi} = 1$

$d = 0$

① sine



② linear function $y = 2$

③ linear function $y = mx + b$

slope $= \frac{rise}{run}$

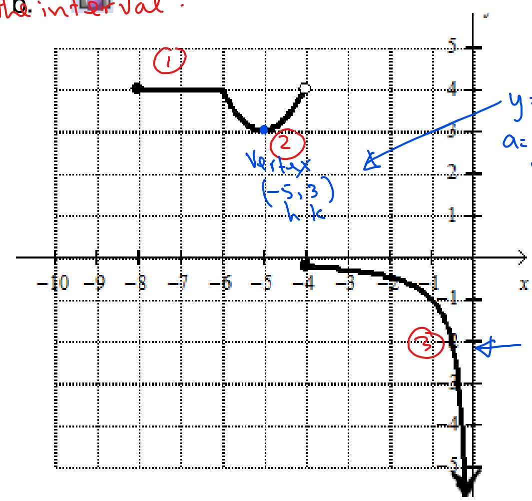
$m = \frac{1}{2}$

$b = -4$

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

$$f(x) = \begin{cases} 2\sin x + 3, & -5 \le x < 3 \\ 2, & 3 \le x \le 5 \\ \frac{1}{2}x - 4, & 5 < x \end{cases}$$

b.



$y = a(x-h)^2 + k$

$a = 1$

$y = (x+5)^2 + 3$

Vertex $(-5, 3)$ h, k

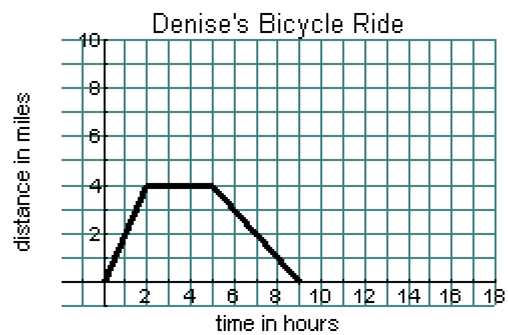
Rational function $y = \frac{1}{x}$

$$f(x) = \begin{cases} 4, & -8 \le x \le -6 \\ (x+5)^2 + 3, & -6 < x < -4 \\ \frac{1}{x}, & -4 \le x < 0 \end{cases}$$

Homework:
↳ Journal unit 1 # 4abc
↳ pg. 51 # 1, 3, 8

4. Bacteria divides into two every 20 minutes. If you start with a 3000 sample and after 1 hour apply an antibecterial solution, the bacteria population decreases at 1000 bacterium per minute for the first 5 minutes and then remains constant for 2 minutes before it starts to divide again.
   a. Sketch the function.
   b. Give an equation that models this.

5. Denise took a bicycle ride away from her home today. She left home at 12 p.m. and arrived back at home at 9 pm. The graph shown represents Denise's distance from home during her ride. Let the function d(t) represent Denise's distance in miles from home during her trip in terms of the time in hours. Create an algebraic model for this graph.



8. Finally, functions can also be described as **continuous** or **discontinuous**. What can cause a discontinuity in a function? Show examples.

Gaps can be created by:

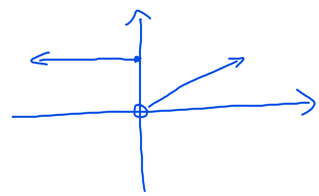
$\frac{\text{numerator}}{\text{denominator}}$

① Rational functions → restrictions

ex: $f(x) = \frac{1}{x-1}$ is discontinuous at $x = 1$ because we cannot divide zero!

set denominator $\neq 0$ → Vertical Asymptote.

② Piecewise functions → graphs are not connecting.



Thinking Question on Test

9. Find the values of each constant that would make this function continuous. (Pg. 52 # 8.)

$$f(x) = \begin{cases} 2x + a, & x \le -1 \\ 22, & -1 < x \le 3 \\ -bx^2 + 31, & 3 < x \le 5 \\ \sqrt{cx} + b, & 5 < x \end{cases}$$

→ a = ?
b = ?
c = ?

To find a: ① = ②

sub $x = -1$

$2x + a = 22$
$2(-1) + a = 22$
$-2 + a = 22$
$a = 24$

At $x = 3$:
$22 = -bx^2 + 31$
$22 = -b(3)^2 + 31$
$22 - 31 = -9b$
$-9 = -9b$
$1 = b$

At $x = 5$:
$-bx^2 + 31 = \sqrt{cx} + b$
$b = 1$
$-1x^2 + 31 = \sqrt{cx} + 1$
$-(5)^2 + 31 = \sqrt{c(5)} + 1$
$-25 + 31 = \sqrt{5c} + 1$
$6 - 1 = \sqrt{5c}$
$25 = 5c$
$5 = c$

$b = 1$

$c = 5$