1. The following chart shows "living wage" jobs in Rochester per 1000 working age adults over a 5 year period.

Year	2016	2017	2018	2019	2020
Jobs	670	730	775	805	830

   (a) What is the average rate of change in the number of living wage jobs from 2016 to 2018?

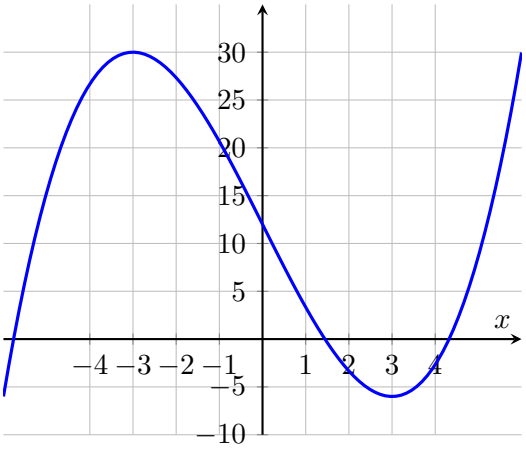
   (b) What is the average rate of change in the number of living wage jobs from 2018 to 2020?

2. A ball is thrown into the air by a baby alien on a planet in the system of Alpha Centauri with a velocity of 22 feet per second (ft/s). Its height in feet after t seconds is given by $y = 22t - 13t^2$

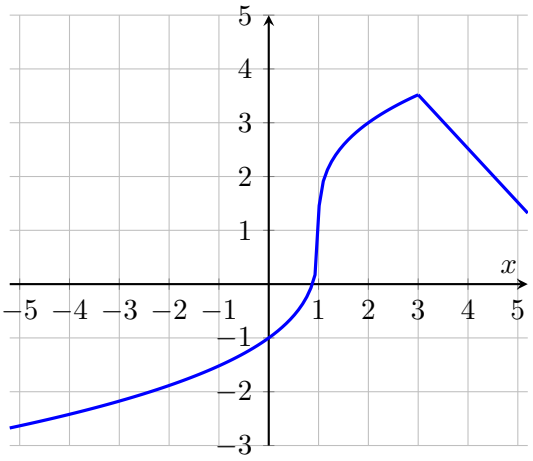
   (a) Find the average velocity for the time period beginning when $t = 2$ and lasting 0.01 s, 0.005 s, 0.002 s,0.001 s.

   (b) Estimate the instantaneous velocity when $t = 2$.

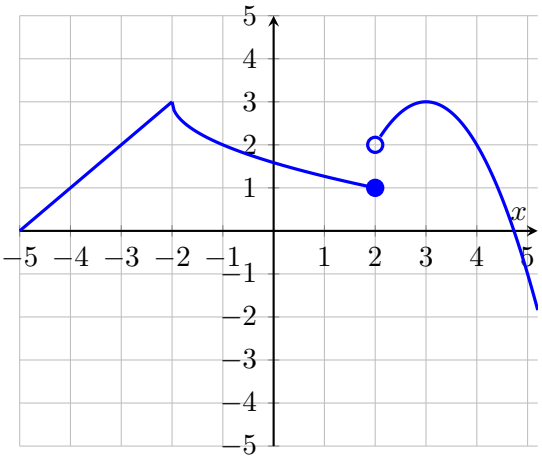
3. The graph of $f(x)$ is shown below. Estimate and list the value of x where $f(x)$ has a horizontal tangent.



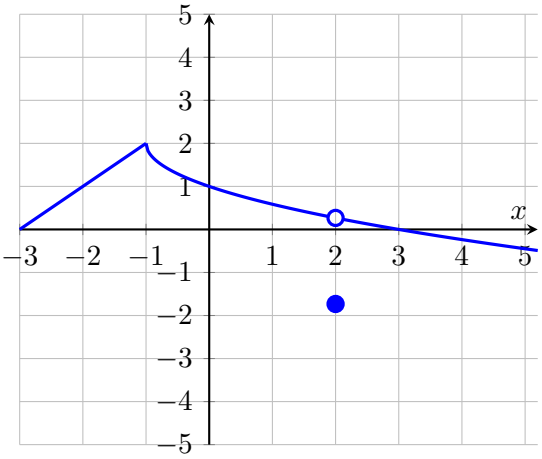
4. List all the numbers x at which the function graphed below is not differentiable.



5. List all the numbers x at which the function graphed below is not differentiable.



6. List all the numbers x at which the function graphed below is not differentiable.



7. Let f be the function defined below.

$$f(x) = \begin{cases} \dfrac{x^2-4}{x-2} & \text{if} \quad x \neq 2 \\ -1 & \text{if} \quad x = 2 \end{cases}$$

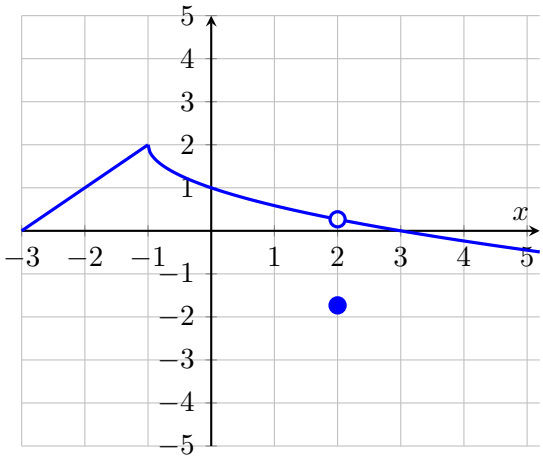
Determine if each statement below is true.

(a) f has a limit at $x = 2$.

(b) f is continuous at $x = 2$

(c) f is differentiable at $x = 2$.

8. List all the numbers x at which the function graphed below is not differentiable.



9. If $f(x) = 19x + 9$, find $f'(9)$.

10. If $f(x) = 13$, find $f'(2)$.

11. Find the derivative function for each function below.

(a) If $f(x) = x^{10}$, find $f'(x)$.

(b) If $g(x) = -7x^4$, find $g'(x)$.

(c) If $h(x) = \dfrac{1}{x^5}$, find $h'(x)$.

Answer Key

1 **(a)** 52.5 Jobs/Year **(b)** 27.5 Jobs/Year

2 **(a)** Approximately -30.13 ft/s ; -30.065 ft/s ; -30.026 ft/s and -30.013 ft/s respectively **(b)** -30 ft/s

3 $x = -3$ and $x = 3$

4 $x = 1$ and $x = 3$

5 $x = -2$ and $x = 2$

6 $x = -1$ and $x = 2$

7 **(a)** true **(b)** false **(c)** false

8 $x = -1$ and $x = 2$

9 $f'(9) = 19$

10 $f'(2) = 0$

11 **(a)** $f'(x) = 10x^9$ **(b)** $g'(x) = -28x^3$ **(c)** $h'(x) = -\dfrac{5}{x^6}$