Mathematics I - Practice of concept questions

21/22

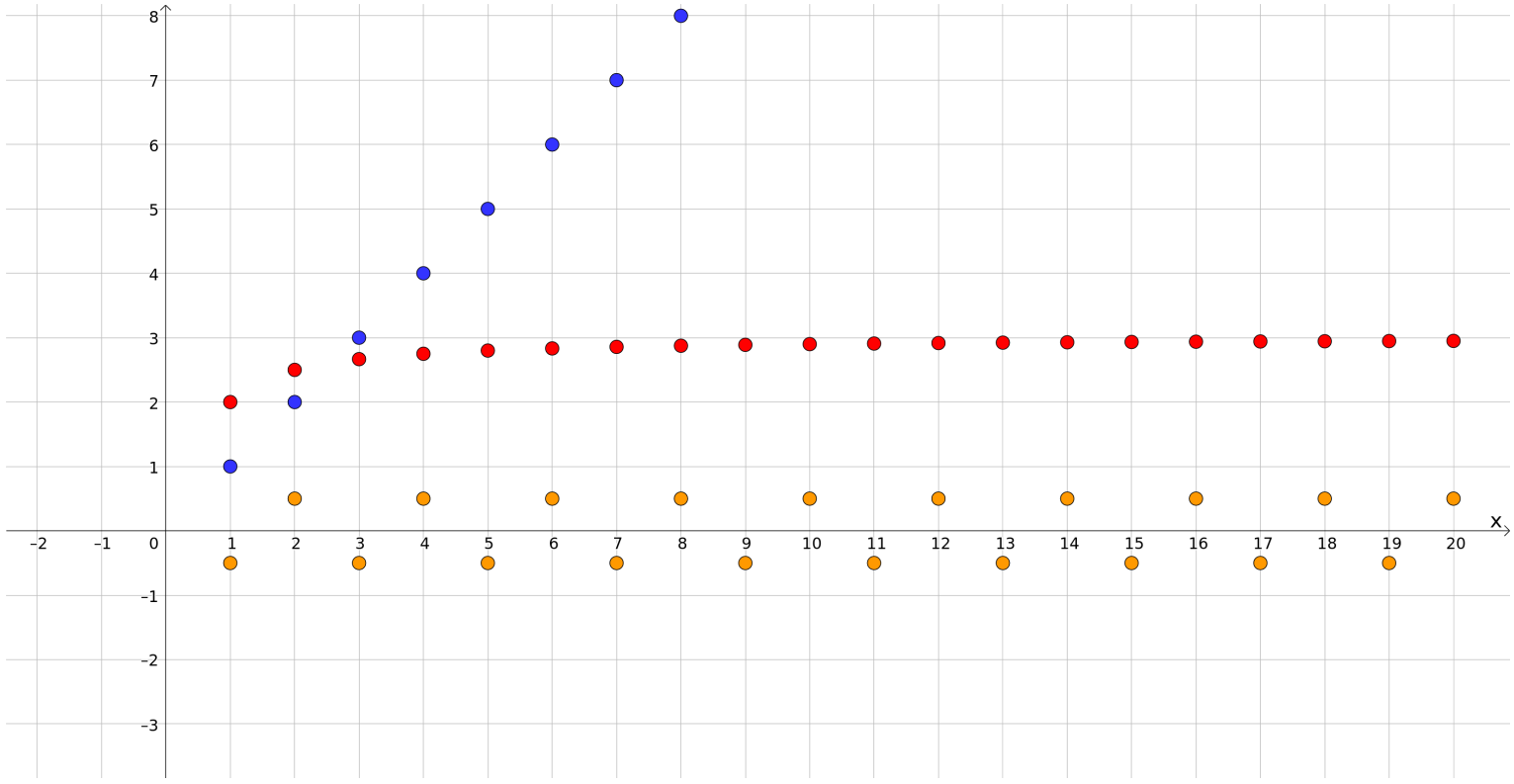
Exercise

Find infimum, minimum, maximum and supremum:

1. $\{1, 2, 3, 4\}$
2. $[-2, 3]$
3. $(-2, 3)$
4. $(-2, 3]$
5. $[-2, -1) \cup (0, 25]$
6. $(-7, -0) \cup (1, 2)$
7. $[0, \infty)$
8. $\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots\}$
9. $\mathbb{N}$

Exercise

Which of these sequences are bounded?



A blue

B red

C yellow

Exercise

Find non-decreasing sequences.

A $a_n = \ln n$

B $a_n = e^{-n}$

C $a_n = -4$

D $a_n = \dfrac{(-1)^n}{3^n}$

E $a_n = (-2)^n$

Exercise

Find a sequence, which is

1. bounded and covergent
2. bounded and divergent
3. unbounded and covergent
4. unbounded and divergent

Exercise

Let $a_n = 3, 7, 4, 1/2, \pi, -1$. Find $b_n = a_{2n}$:

A $6, 14, 8 \ldots$

B $5, 9, 6 \ldots$

C $7, 1/2, -1 \ldots$

D $4, 1/2, \pi \ldots$

By:`https://www.cpp.edu/conceptests/question-library/mat116.shtm`

Exercise (True or false)

Let $\lim a_n = A \in \mathbb{R}$ and $\lim b_n = B \in \mathbb{R}$.
If $a_n < b_n$, then $A < B$.

Exercise

1. $2+\infty$
2. $-\infty+3$
3. $\pi\infty$
4. $-4(-\infty)$
5. -7∞
6. $\frac{\infty}{-3}$
7. $\frac{5}{\infty}$

Exercise

Find the convergent subsequence:

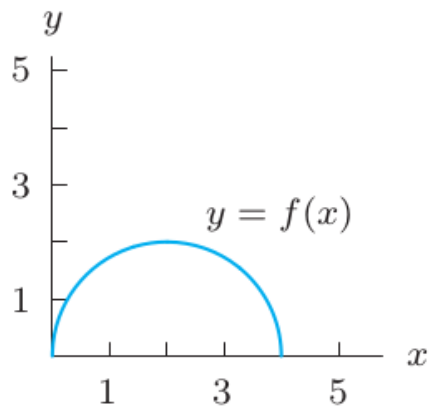
A $a_n = (-1)^n$

B $a_n = \{0, 2, 0, 0, 2, 0, 0, 0, 2, 0, 0, 0, 0, 2, \ldots\}$

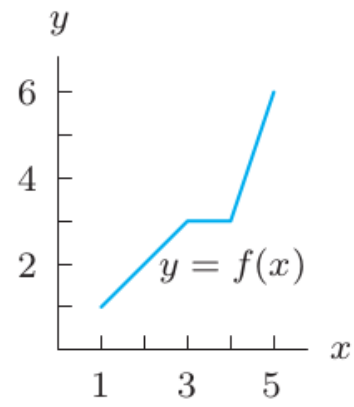
Exercise

Find the domain and range for the following mappings:

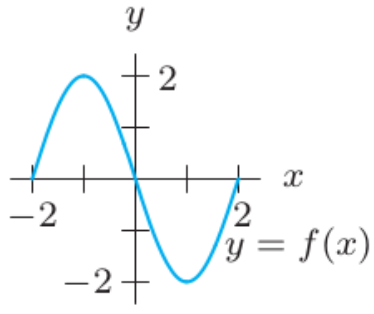
20.



21.



22.



23.

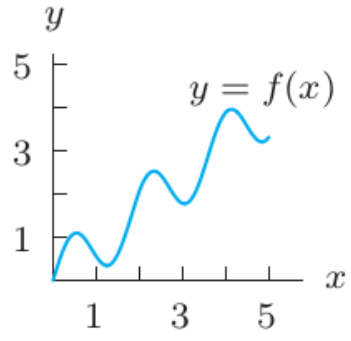
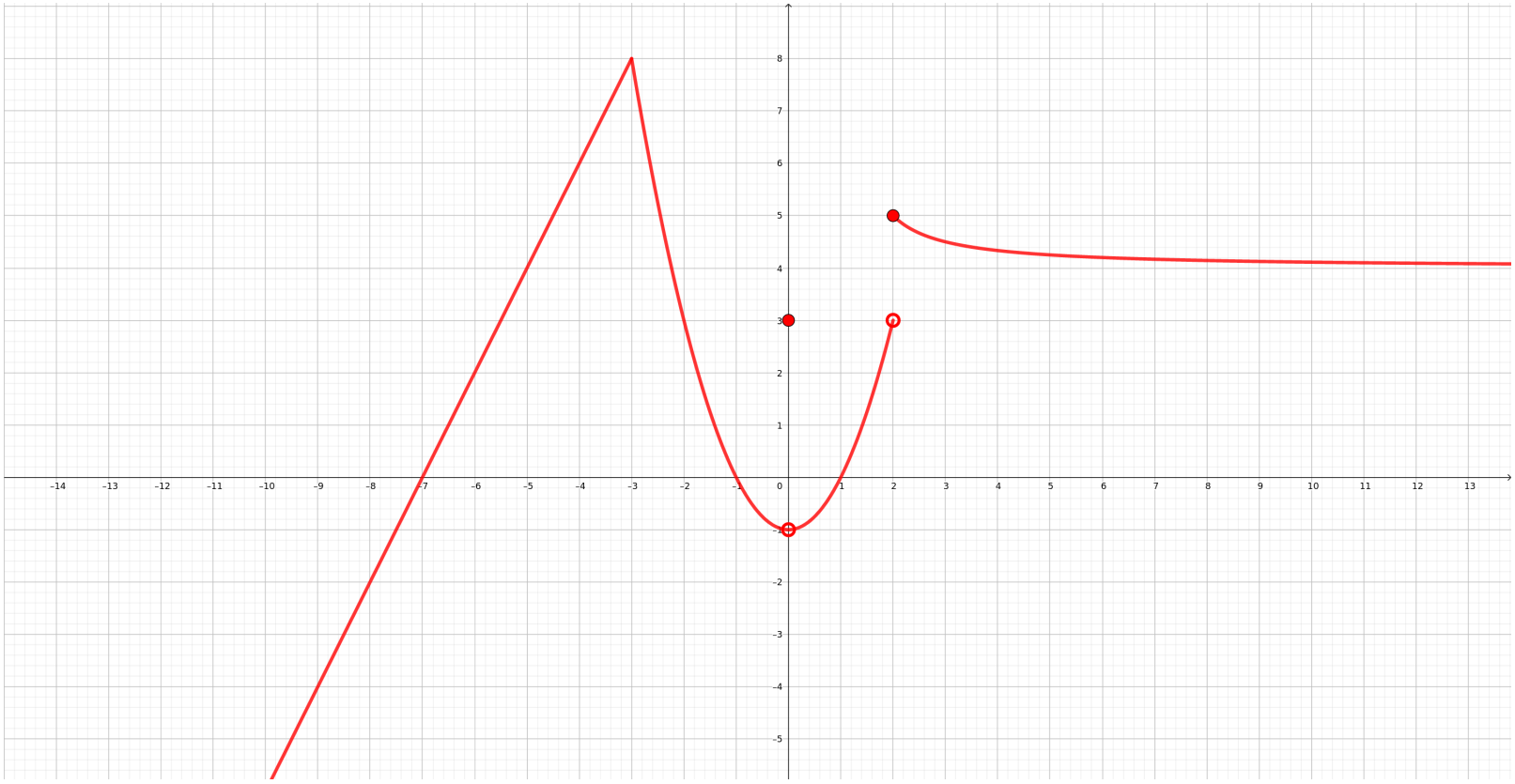


Figure: Calculus: Single and Multivariable, 6th Edition, Hughes-Hallett, col.

Exercise

Find the image:

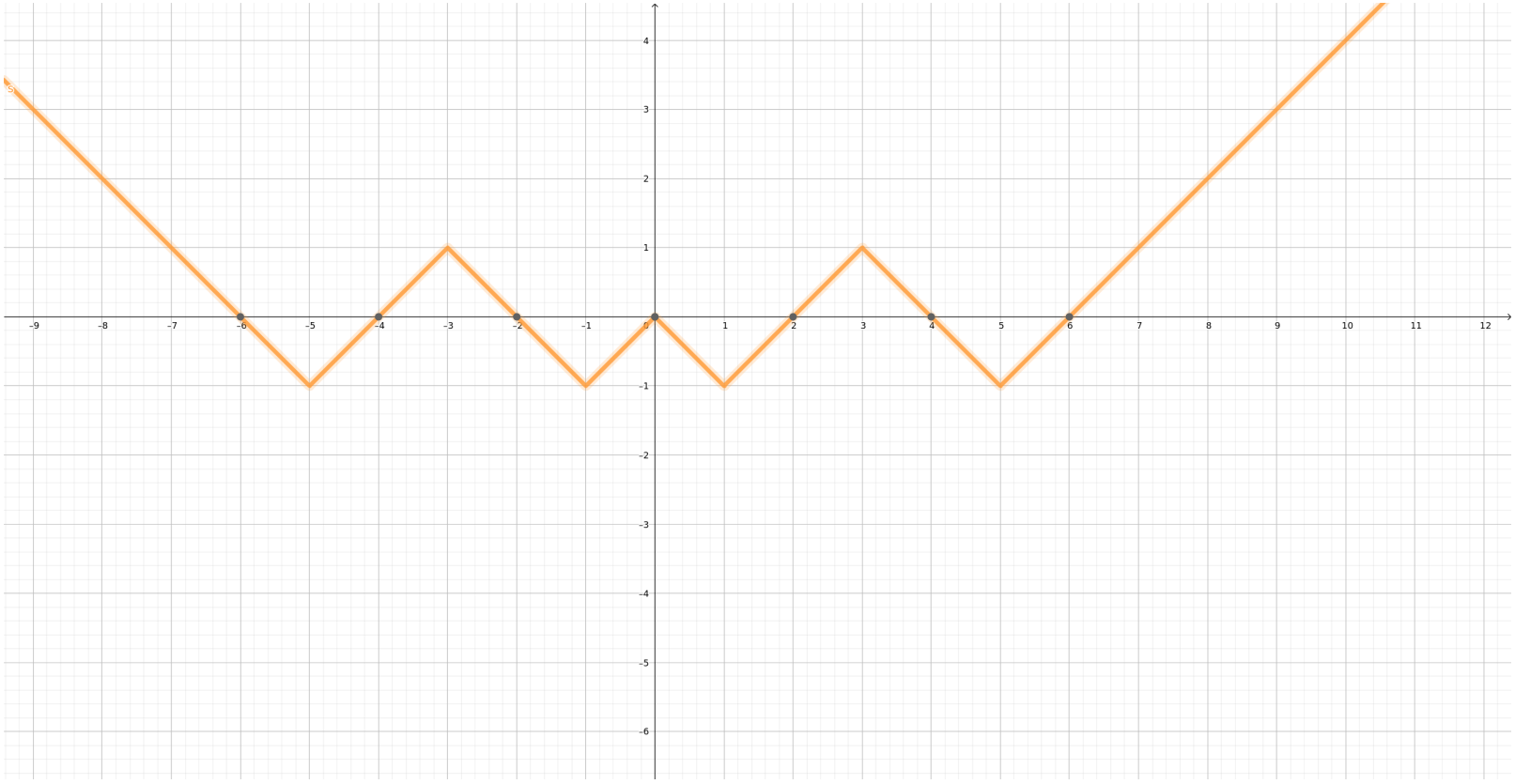
A $[-6, -2]$ B $[-1, 1)$ C $[0, 2)$ D $[2, \infty)$



Exercise

Find the preimage:

A $\{-1\}$ B $[2, 3]$ C $[0, 1]$ D $[0, 1)$



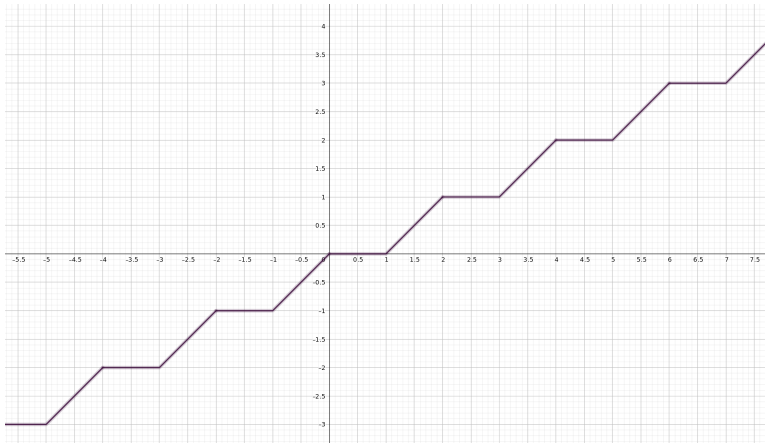
Exercise

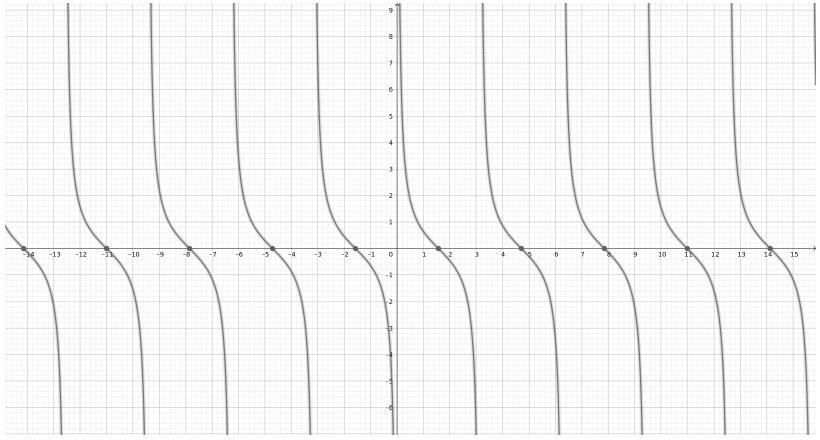
A e^x B x^3 C $\sin x$ D $\tan x$ E $\frac{1}{x}$

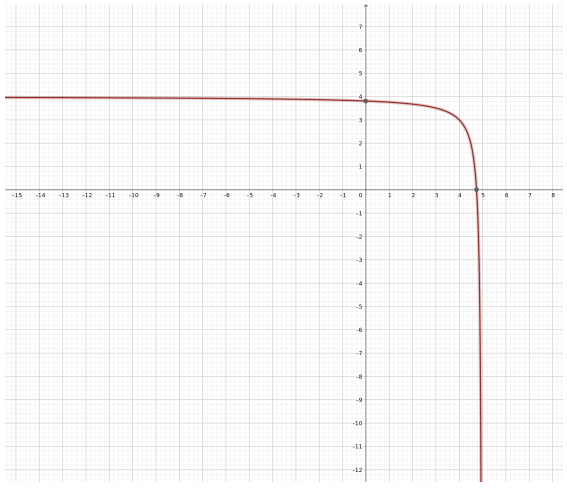
Which functions are onto?
Which functions are one-to-one?
Which functions are bijections?

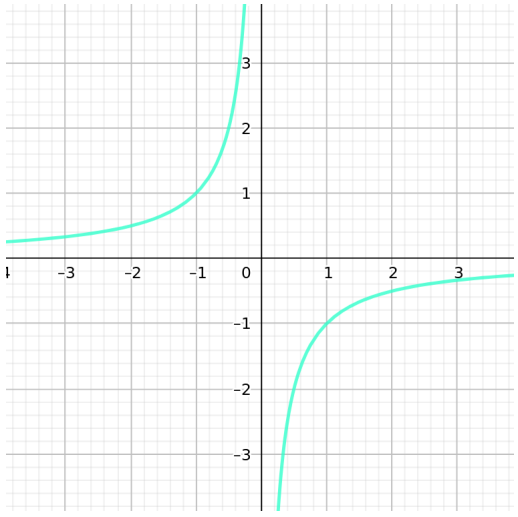
Exercise

Decide, which functions are monotone on its domain:



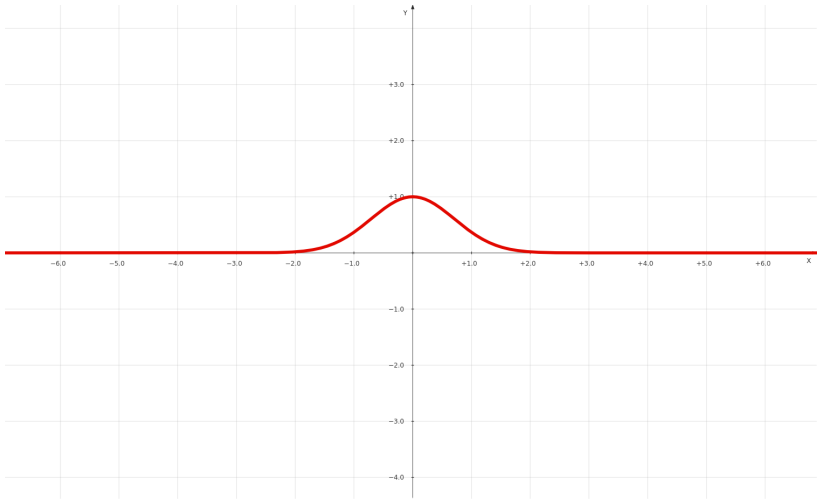


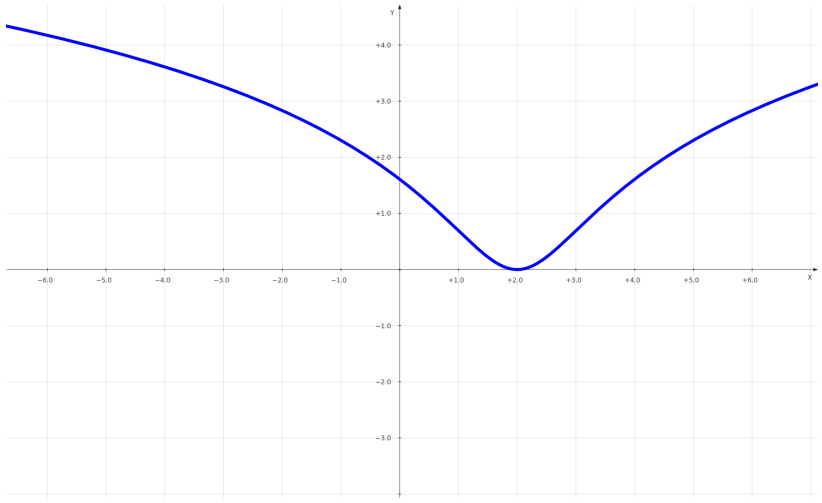


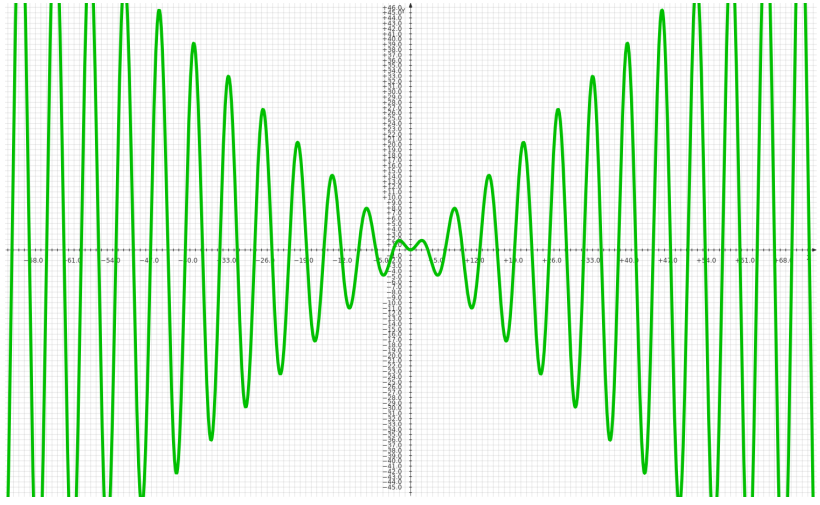


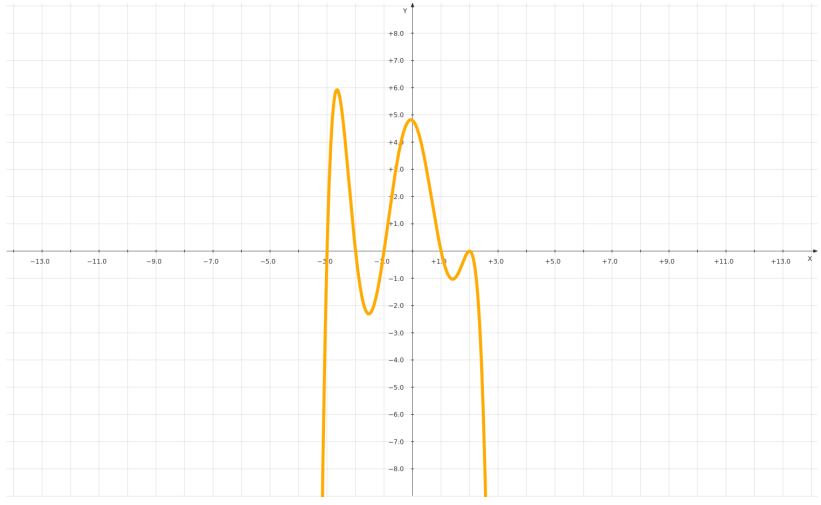
Exercise

Decide, which functions are bounded, bounded from above, below:



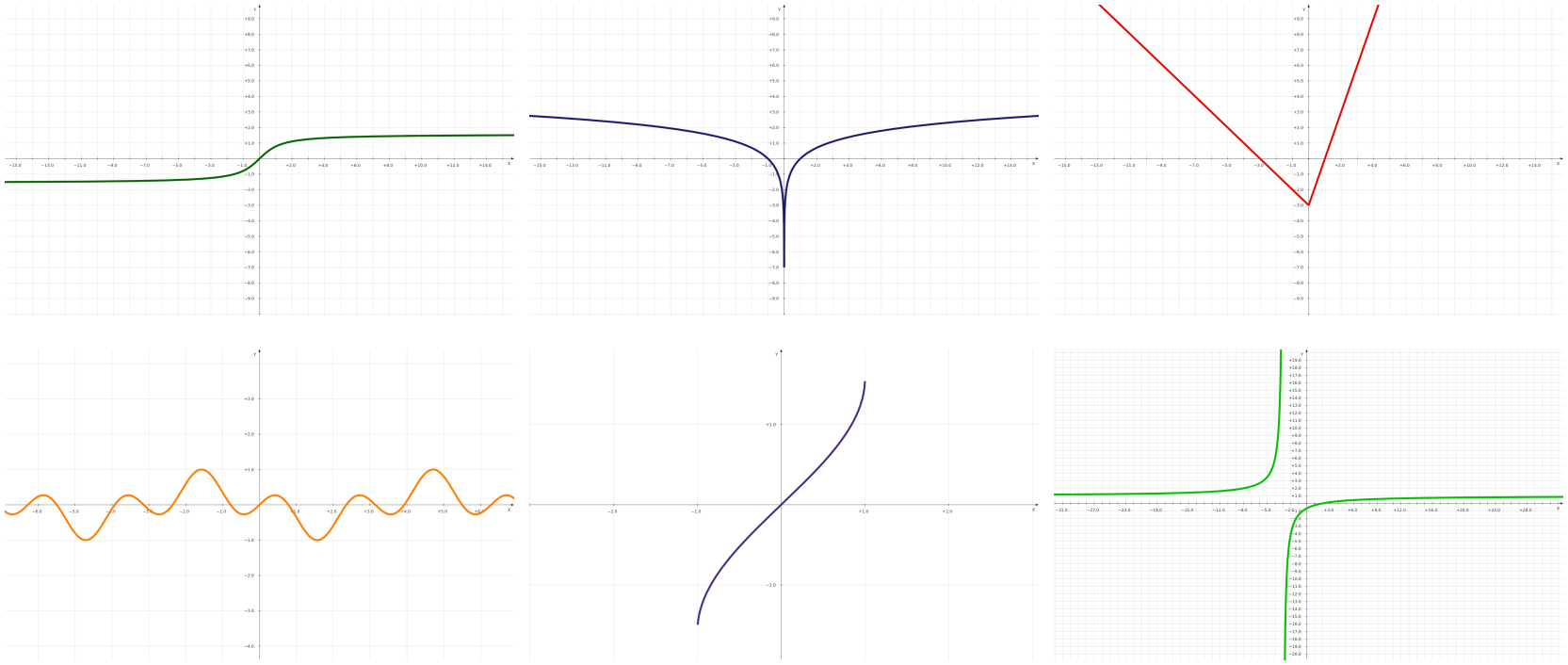






Exercise

Decide, which functions are even or odd:



Decide, which functions are even or odd:

A $x^3 + 1$

B $x(x^2 + 1)$

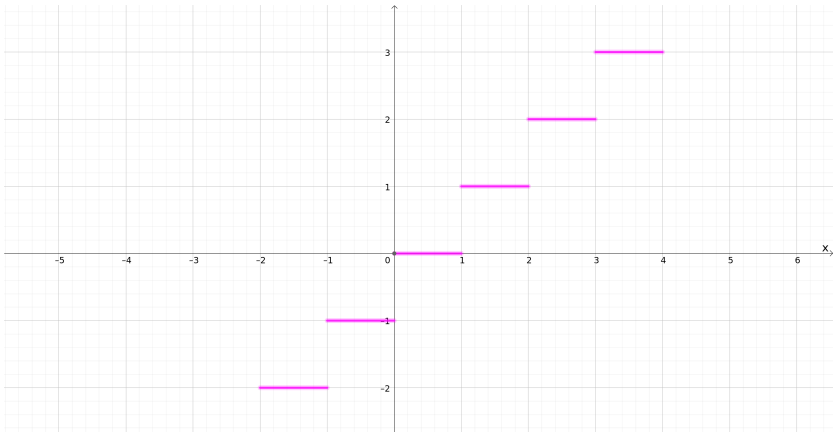
C $|x - 2|$

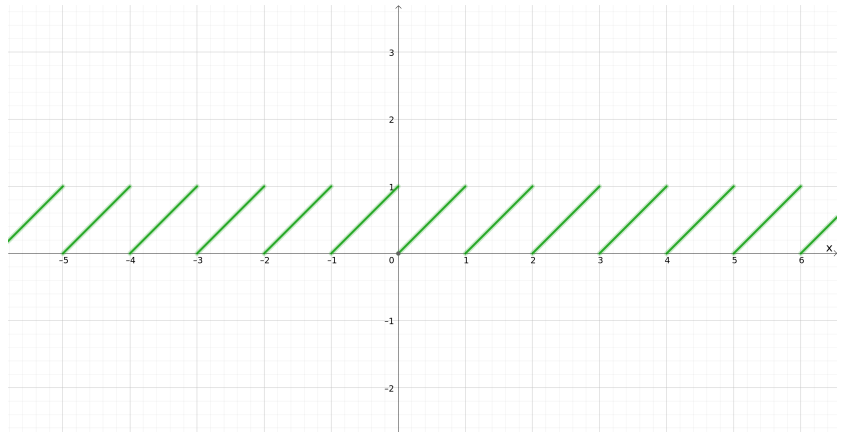
D $e^{x^2} \sin x$

E $|1 + \cos x|$

Exercise

Decide, which functions are periodic





Exercise

Find $\lim_{x \to 0} f(x)$

A -3 B 0 C 5 D 7 E ∞

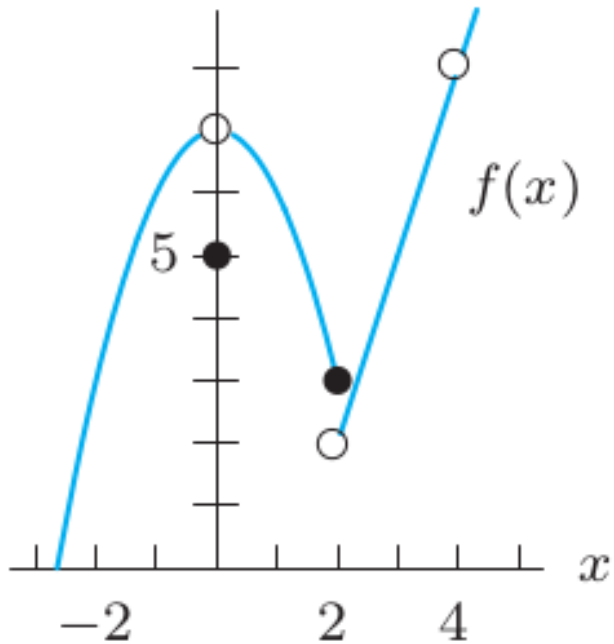


Figure: Calculus: Single and Multivariable, Hughes-Hallet

Exercise

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

A ∞

B 3

C 2

D 0

E does not exist

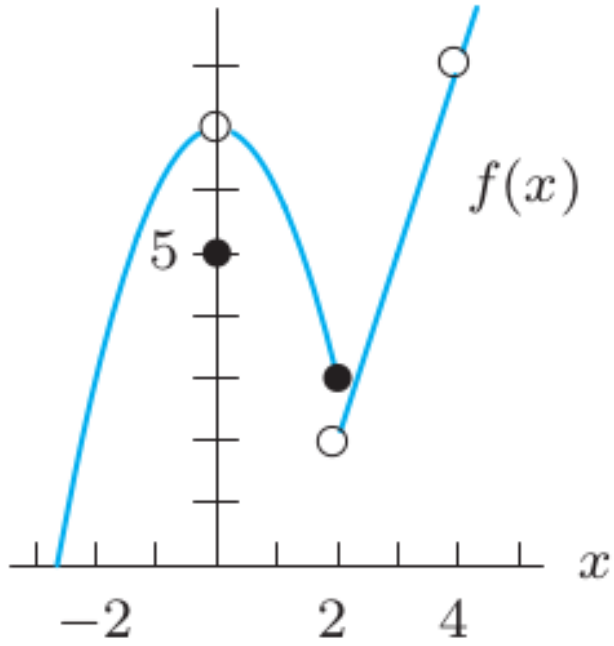


Figure: Calculus: Single and Multivariable, Hughes-Hallet

Exercise

Find $\lim_{x \to 4} f(x)$

A 4	C 0	E does	exists
B 8	D ∞	not	

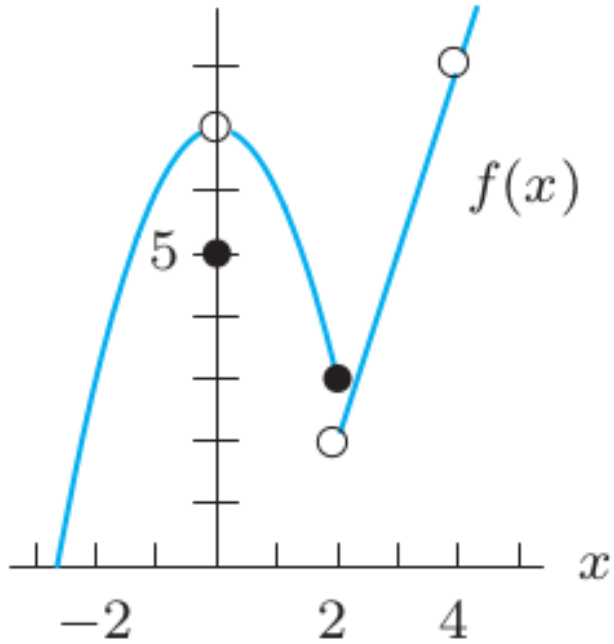


Figure: Calculus: Single and Multivariable, Hughes-Hallet

Exercise

$$\lim_{x\to\infty} \ln\left(\frac{x-1}{x+2}\right)$$

A 0 B 1 C $\ln 1$ D $-\frac{1}{2}$ E ∞

Exercise

Find local extrema:

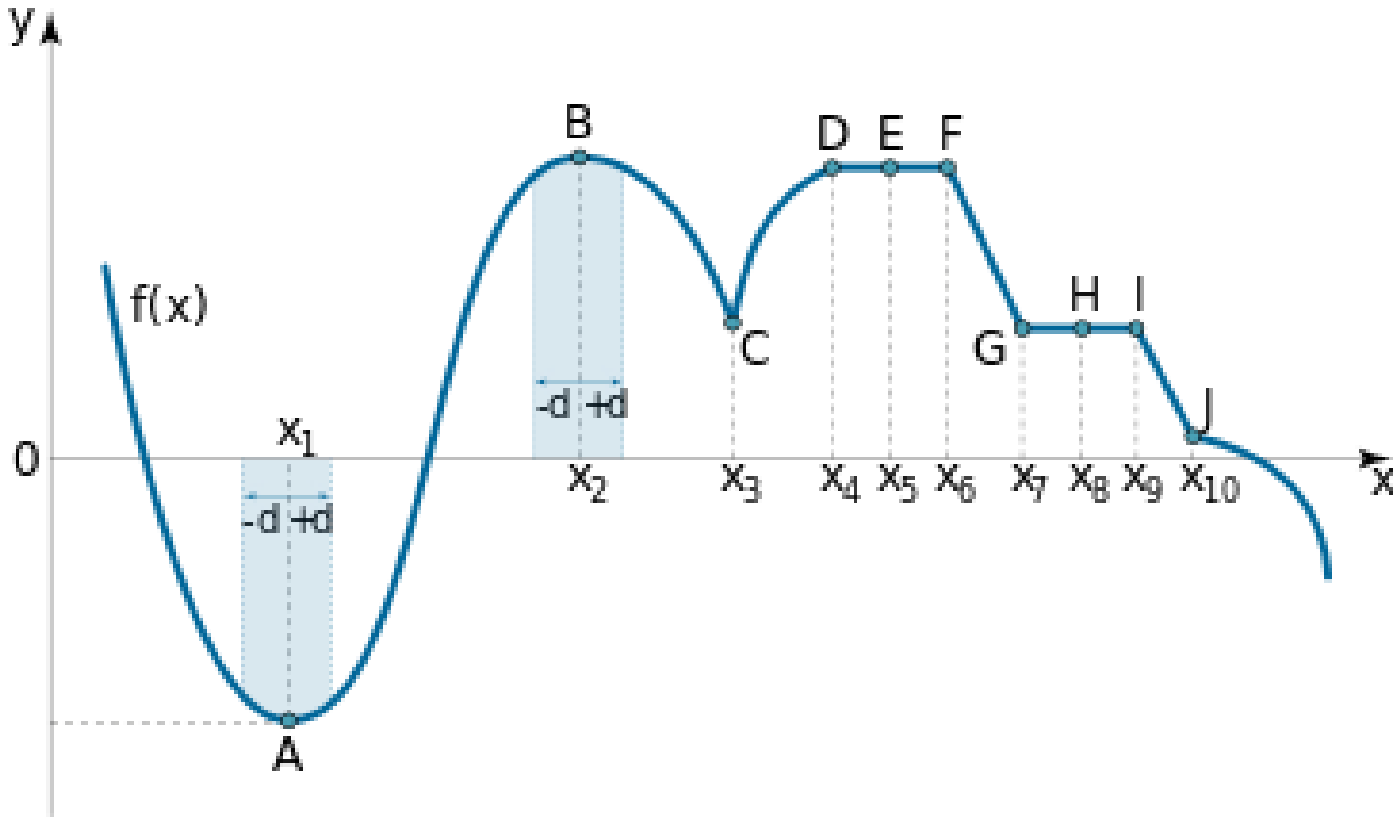


Figure: `https://math24.net/local-extrema-functions.html`

Exercise

$$\lim_{x\to\infty} \frac{\ln x}{x} =$$

A ∞ B 0 C 1 D 不存在

Exercise

Let us assume that a function $y = f(x)$ is continuous at $\mathbb{R}$. Sketch f.

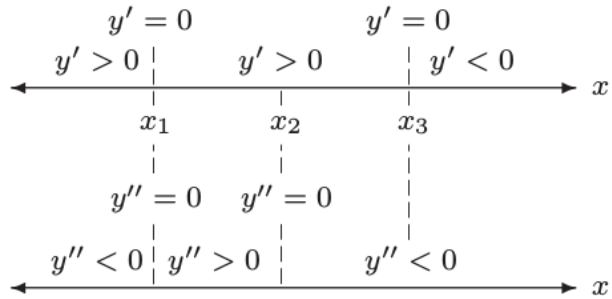


Figure: Calculus, Hughes-Hallet, Gleason, McCallum