Caml
MCQ #5
Thursday, September the 18th 2025

1. **What does the evaluation result of the following phrase contain?**

```
let f x y =
  match (x, y) with
    (a, b) when a > b -> false
   | (a, b) -> true
   | _ -> failwith "error: invalid tuple";;
```

(a) *val f : 'a -> 'a -> bool = <fun>*
(b) *val f : ('a * 'a) -> bool = <fun>*
(c) *Warning ... : this match case is unused.*
(d) *Warning ... : this pattern-matching is not exhaustive.*
(e) An error.

---

2. **What does the evaluation result of the following phrase contain?**

```
let f a (b, c) = match (a, b, c) with
    (false, _, _) -> false
  | (true, a, b) when a = b -> true
  | (_, _, a) -> a ;;
```

(a) *val f : bool * bool * bool -> bool = <fun>*
(b) *val f : bool -> bool * bool -> bool = <fun>*
(c) *Warning ... : this match case is unused.*
(d) *Warning ... : this pattern-matching is not exhaustive.*
(e) An error.

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3. **What does the following function displays called with `f 5`?**

```
let rec f n = match n with
    0 -> ()
  | x when n mod 2 = 0 -> print_int n; f (n - 1)
  | n -> f (n - 1) ; print_int n ;;
```

(a) *53124*
(b) *12345*
(c) *54321*
(d) *42135*
(e) Nothing, the function does not terminate!

---

4. **What does the following function calculate when called with `f n` ($n \geq 1$)?**

```
let rec f n = match n with
  | 0 -> 0
  | n -> f (n - 1) + n * n ;;
```

(a) $2n!$
(b) $(2n)!$
(c) $\sum_{i=0}^{n} 2i$
(d) $\sum_{i=0}^{n} i^2$
(e) Nothing, the function does not terminate!

5. **What will be the last result after successive evaluations of the following phrases?**

```
let rec f x k = match x with
  | 0 -> 1
  | x -> f (x + k) k - x ;;

f (-8) 2 ;;
```

(a) *-21*
(b) *-19*
(c) *19*
(d) *21*
(e) Nothing, the function does not terminate!

---

6. **What will be the last result after successive evaluations of the following phrases?**

```
let rec f a b =
  if a < 0 || b < 0 then
    0
  else
    if a < b then
      f (b - a) a - 1
    else
      f a (a - b) + 1 ;;

f 15 5 ;;
```

(a) *- : int = 1*
(b) *- : int = 0*
(c) *- : int = -1*
(d) *- : int = 10*
(e) Nothing, the function does not terminate!

---

7. **What will be the last result after successive evaluations of the following phrases?**

```
let rec g n k =
  if k = 0 then
    0
  else
    if n mod 2 = 0 then
      n + g (n - 1) (k - 1)
    else
      n * g (n - 1) k ;;

g 3 1 ;;
```

(a) *- : int = 6*
(b) *- : int = -10*
(c) *- : int = 3*
(d) *- : int = 1*
(e) Nothing, the function does not terminate!

8. **What will be the last result after successive evaluations of the following phrases?**

```
let rec f n k =
  if k = 0 then
    1
  else
    if n mod k = 0 then
      1 + f (n - k) k
    else
      f n (k - 1) ;;

f 15 5 ;;
```

(a) `- : int = 3`
(b) `- : int = 1`
(c) `- : int = 0`
(d) `- : int = 4`
(e) Nothing, the function does not terminate!

---

9. **For which values of `n` the call `h n` does not stop?**

```
let rec h n =
  if n = 0 then
    h 2
  else
    if n mod 2 = 1 then
      1
    else
      h (n - 2) + 1 ;;
```

(a) `n = 0`
(b) `n = 1`
(c) `n = 1234567890`
(d) `n = 123456789`
(e) The function always stops.

---

10. **How many calls to `f` will be processed with `f 3` (`f 3` included)?**

```
let rec f n =
  if n <= 1 then
    n
  else
    2 * f (n - 1) + f (n - 1) ;;
```

(a) 3
(b) 4
(c) 7
(d) 14
(e) An infinity.

MCQ 5

Thursday, 18 September

Question 11

Consider the function $f : [\![0,6]\!] \longrightarrow [\![0,10]\!]$ defined by the following table:

x	0	1	2	3	4	5	6
$f(x)$	1	4	2	8	2	4	2

Then: [redacted]

a. $f([\![0,6]\!]) = [\![1,8]\!]$ [redacted]

b. $f([\![0,6]\!]) \subset \{0,1,2,3,4,8\}$ [redacted]

c. $f^{-1}(\{1,2\}) = \{0,2\}$ [redacted]

d. $\{2,3,4\} \subset f^{-1}(\{2,8\})$

e. None of the others

Question 12

Consider the function $f : [\![0,6]\!] \longrightarrow [\![0,10]\!]$ defined by the following table:

x	0	1	2	3	4	5	6
$f(x)$	1	4	2	8	2	4	2

Then:

a. f is injective, not surjective. [redacted]

b. f is surjective, not injective. [redacted]

c. f is bijective.

d. f is neither injective nor surjective. [redacted]

Question 13

Let E and F be two sets and $f : E \longrightarrow F$. The function f is injective if and only if:

a. $\forall (x, x') \in E^2, x = x' \implies f(x) = f(x')$

b. $\forall (x, x') \in E^2, x \neq x' \implies f(x) = f(x')$ [redacted]

c. $\forall y \in F, \exists x \in E$ such that $y = f(x)$.

d. $\forall x \in E, \exists y \in F$ such that $y = f(x)$.

e. None of the others [redacted]

Question 14

Let E and F be two sets and $f : E \longrightarrow F$. The function f is surjective if and only if:

a. $\forall (x, x') \in E^2, x = x' \implies f(x) = f(x')$ [redacted]

b. $\forall (x, x') \in E^2, x \neq x' \implies f(x) \neq f(x')$

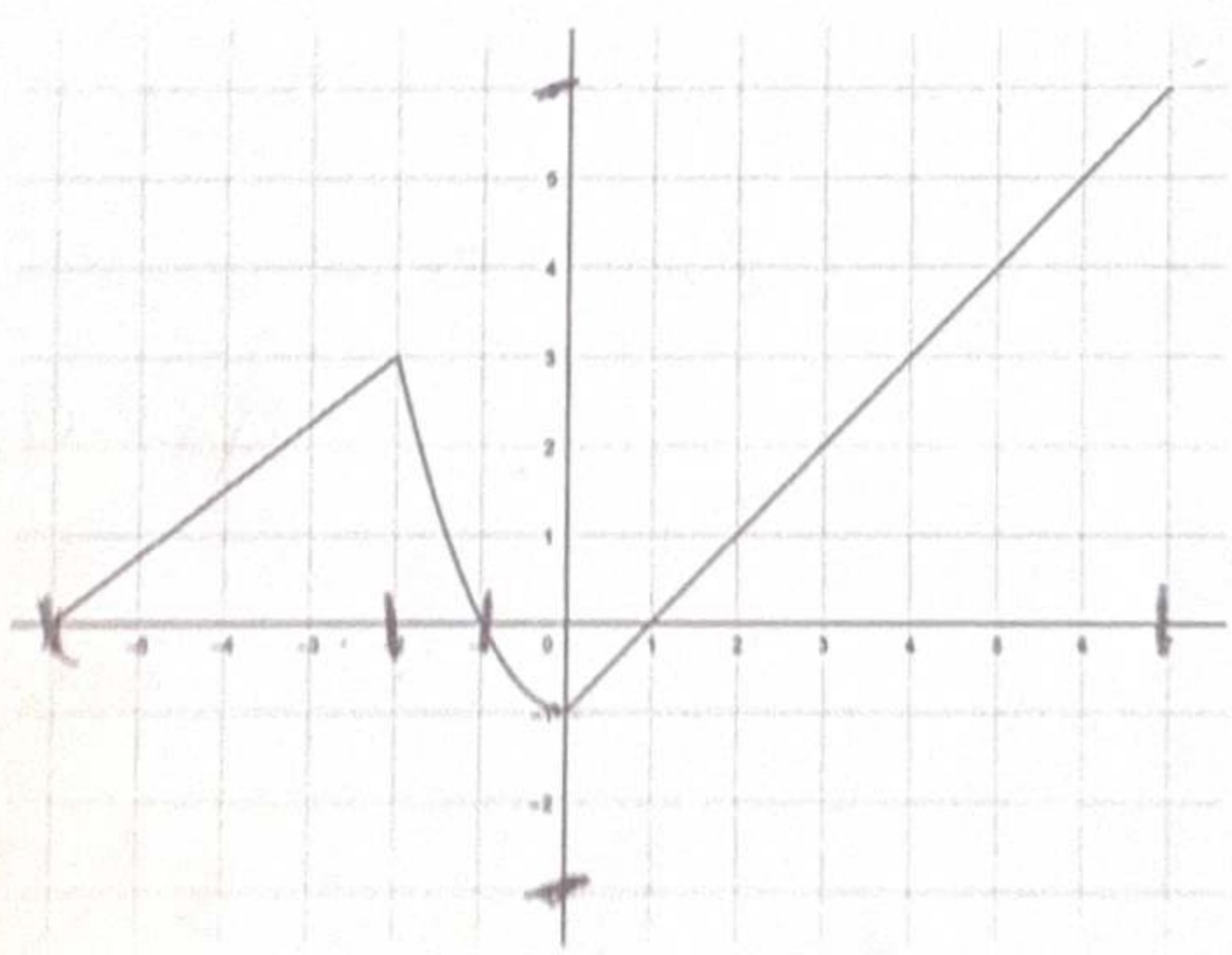
c. $\forall y \in F, \exists x \in E$ such that $y = f(x)$.

d. $\forall x \in E, \exists y \in F$ such that $y = f(x)$.

e. None of the others

Question 15

Consider the function $f : [-6, 7] \longrightarrow [-3, 6]$ defined by the following graph:



a. f is injective from $[-6, 7]$ to $[-3, 6]$. [redacted]

b. f is injective from $[-2, 7]$ to $[-3, 6]$.

c. f is surjective from $[-6, 7]$ to $[-3, 6$

d. f is surjective from $[-1, 7]$ to $[-1, 6$

e. None of the others

Question 13

Let E and F be two sets and $f : E \longrightarrow F$. The function f is injective if and only if:

a. $\forall (x, x') \in E^2, x = x' \implies f(x) = f(x')$ [redacted]

b. $\forall (x, x') \in E^2, x \neq x' \implies f(x) = f(x')$

c. $\forall y \in F, \exists x \in E$ such that $y = f(x)$.

d. $\forall x \in E, \exists y \in F$ such that $y = f(x)$.

e. None of the others [redacted]

Question 14

Let E and F be two sets and $f : E \longrightarrow F$. The function f is surjective if and only if:

a. $\forall (x, x') \in E^2, x = x' \implies f(x) = f(x')$ [redacted]

b. $\forall (x, x') \in E^2, x \neq x' \implies f(x) \neq f(x')$

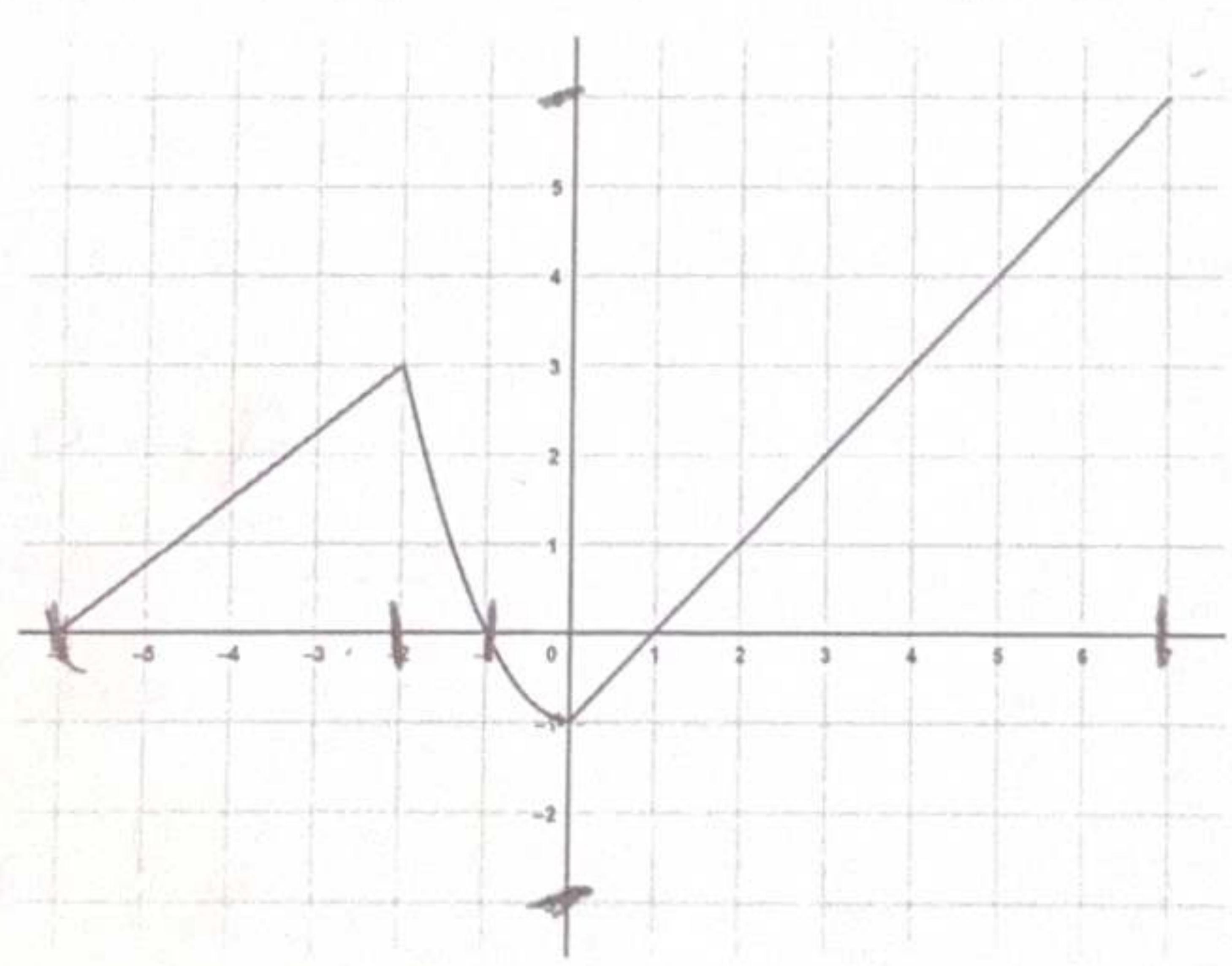
c. $\forall y \in F, \exists x \in E$ such that $y = f(x)$. [redacted]

d. $\forall x \in E, \exists y \in F$ such that $y = f(x)$. [redacted]

e. None of the others

Question 15

Consider the function $f : [-6, 7] \longrightarrow [-3, 6]$ defined by the following graph:



a. f is injective from $[-6, 7]$ to $[-3, 6]$. [redacted]

b. f is injective from $[-2, 7]$ to $[-3, 6]$.

c. f is surjective from $[-6, 7]$ to $[-3, 6]$

d. f is surjective from $[-1, 7]$ to $[-1, 6]$

e. None of the others

Question 16

Select the correct answer(s):

a. The definition domain of $x \longmapsto \arctan(x)$ is $]0, +\infty[$ [redacted]

b. $\arctan(0) = 0$ [redacted]

c. $\arctan(1) = 0$

d. To find $\arctan(x)$, you search the unique $y \in]0, 2\pi[$ such that $x = \tan(y)$ [redacted]

e. None of the others

Question 17

Consider a set E and a relation $\mathscr{R}$ defined over E. Select the correct definition(s):

a. $\mathscr{R}$ is reflexive if: $\forall\, x \in E,\ x \mathscr{R} x$ [redacted]

b. $\mathscr{R}$ is symmetric if: $\forall\, (x, y) \in E^2,\ x \mathscr{R} y$ and $y \mathscr{R} x$ [redacted]

c. $\mathscr{R}$ is antisymmetric if: $\forall\, (x, y) \in E^2,\ x \mathscr{R} y,\ y \mathscr{R} x$ and $x = y$ [redacted]

d. $\mathscr{R}$ is transitive if: $\forall\, (x, y, z) \in E^3,\ x \mathscr{R} y$ and $y \mathscr{R} z \Longrightarrow x \mathscr{R} z$

e. None of the others

Question 18

Consider the relation $\mathscr{R}$ defined over $E = \mathbb{R}$ by: $\forall\, (x, y) \in E^2,\ x \mathscr{R} y \iff x^2 - y^2 = x - y$. Then:

a. $3 \mathscr{R} -2$ [redacted]

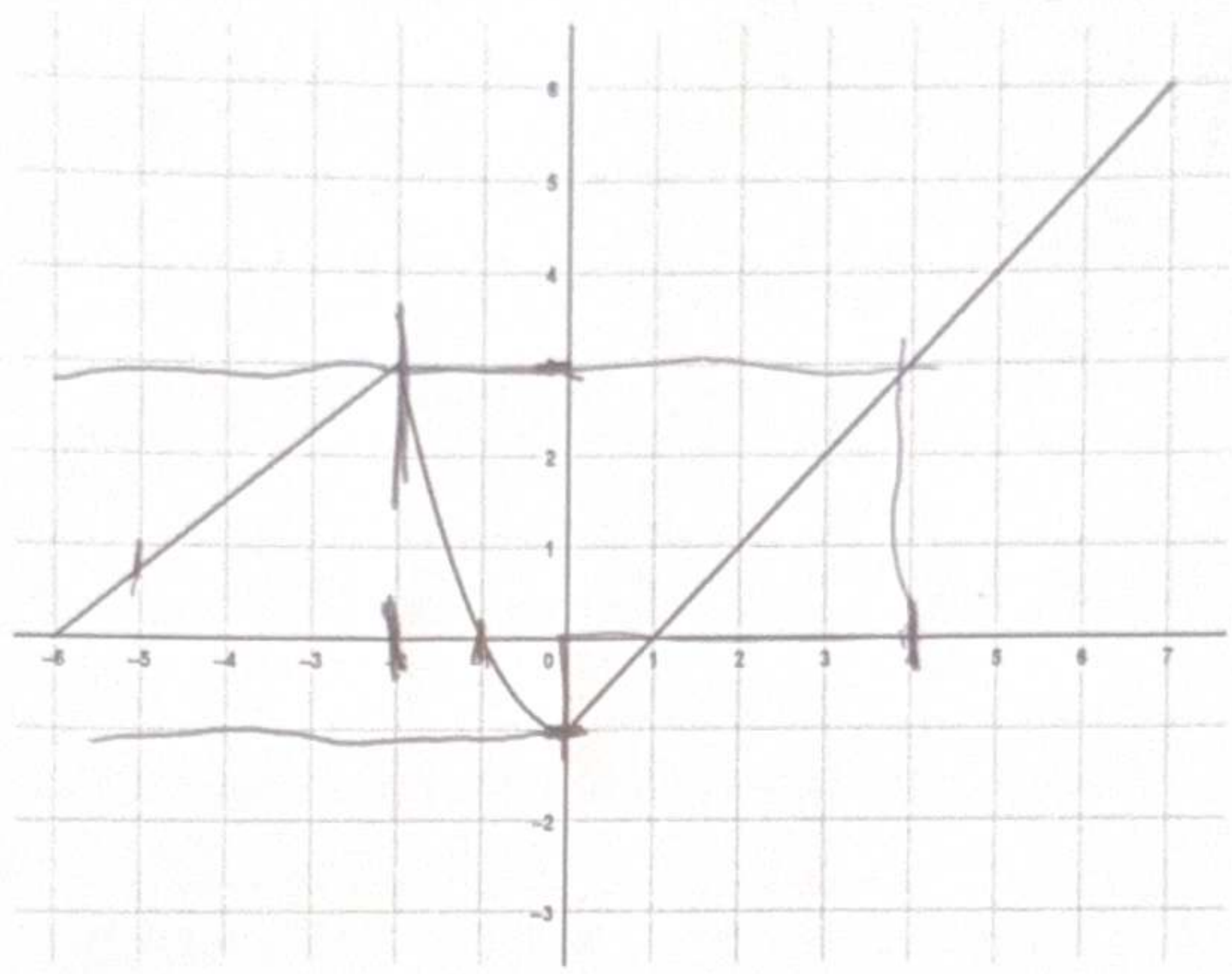
b. $-2 \mathscr{R} 2$

c. $\mathscr{R}$ is reflexive.

d. None of the others

Question 19

Consider the function f defined on $[-6, 7]$ by the following graph:



Then:

a. $f^{-1}(\{0\}) = \{-1\}$ [redacted]

b. $f(\{-1\}) = \{0\}$

c. $f^{-1}([-1, 3]) = [-2, 4]$

d. $f^{-1}([-2, -1]) = \emptyset$

e. None of the others

Question 20

For all real numbers $a > 0$ and $b > 0$, the fraction $F = \dfrac{\frac{1}{a}}{\frac{1}{b} + \frac{1}{a}}$ is equal to:

a. $\dfrac{b+a}{a}$

b. $b+1$

c. $\dfrac{1}{a+1}$

d. $\dfrac{b}{a+b}$

e. None of the others

ALGO	
1	AC
2	B
3	D
4	D
5	D
6	E
7	A
8	E
9	AC
10	C

MATH PC	
11	B D
12	D
13	E
14	C
15	D
16	B
17	A D
18	A C
19	B
20	D