

Math 130 04 – A Survey of Calculus

Homework assignment 1

Due: Tuesday, September 6, 2022

Write your answers on a separate sheet of paper. Write your name at the top of each page you use, and number each page. Remember to number your answers correctly.

General questions

1. What is your major? If you haven't decided yet, what are your options?
2. What other courses are you taking this semester?
3. What do you expect to get from learning calculus?

Algebra

4. Write the following expressions without using exponents.

(a) 2^4

(c) $x^3 \cdot 3^{-2}$

(e) $x^2 - 1$

(b) x^3

(d) $(x^2)^{-2}$

(f) $(3x)^0$

Solution:

(a) $2 \cdot 2 \cdot 2 \cdot 2 = 16$

(d) $\frac{1}{x \cdot x \cdot x \cdot x}$

(b) $x \cdot x \cdot x$

(e) $x \cdot x - 1 = (x + 1)(x - 1)$

(c) $\frac{x \cdot x \cdot x}{3 \cdot 3}$

(f) 1

5. Multiply the following expressions (and simplify them until no factors remain).

(a) $(3x - y)(3x + y)$

(b) $(x - a)^3$

(c) $xy(x + y)(x - y)$

Solution:

(a) $9x^2 - y^2$

(b) $x^3 - 3x^2a + 3xa^2 - a^3$

(c) $x^3y - xy^3$

6. Factor the following expressions.

(a) $2xy^2 - 50x$

(b) $6x^2 - 23x + 20$

Solution:

(a)

$$\begin{aligned} 2xy^2 - 50x &= 2x(y^2 - 25) \\ &= 2x(y + 5)(y - 5) \end{aligned}$$

(b)

$$\begin{aligned} 6x^2 - 23x + 20 &= 6x^2 - 15x - 8x + 20 \\ &= (3x - 4)(2x - 5) \end{aligned}$$

Sets and functions

7. Consider the following sets.

$$A = \{1, 3, 5, 7, 9\} \quad B = \{2, 4, 6, 8\} \quad C = \{1, 2, 3, 7, 8, 9\}$$

(a) For each of the following, say whether it is an element of A , B or C .

- i. 6
- ii. 7
- iii. Anees
- iv. 5

(b) Calculate:

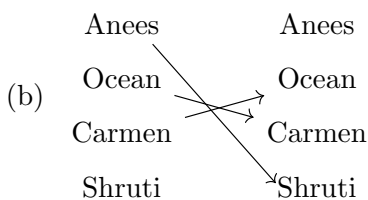
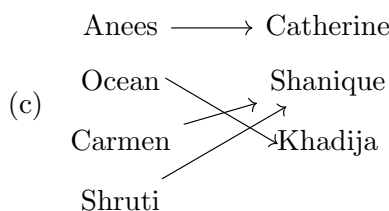
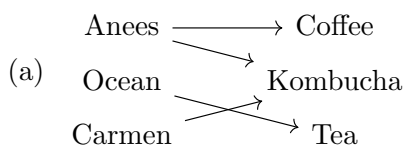
- i. $A \cup B$ (The union of A and B .)
- ii. $A \cap B$ (The intersection of A and B .)
- iii. $A \cup B \cup C$
- iv. $A \cap B \cap C$
- v. $A \cup (B \cap C)$

Solution:

- (a)
- i. $6 \in B$
 - ii. $7 \in A$ and $7 \in C$.
 - iii. Anees is not an element of A , B or C .
 - iv. $5 \in A$.
- (b)
- i. $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
 - ii. $A \cap B = \emptyset$ (the empty set).

- iii. $A \cup B \cup C = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
 iv. $A \cap B \cap C = \emptyset$
 v. $A \cup (B \cap C) = A \cup \{2, 8\} = \{1, 2, 3, 5, 7, 8, 9\}$

8. Write the domain and the range of each of the following correspondences. Which of the following correspondences are functions? Justify your answers.



Solution:

(a)

$$\text{Domain} = \{\text{Anees, Ocean, Carmen}\}$$

$$\text{Range} = \{\text{Coffee, Kombucha, Tea}\}$$

The correspondence **is not** a function, because the element “Anees” of the domain maps to more than one element of the range (“Coffee” and “Kombucha”).

(b)

$$\text{Domain} = \{\text{Anees, Ocean, Carmen, Shruti}\}$$

$$\text{Range} = \{\text{Anees, Ocean, Carmen, Shruti}\}$$

The correspondence **is not** a function, because the element “Shruti” of the domain does not map to any element of the range.

(c)

$$\text{Domain} = \{\text{Anees, Ocean, Carmen, Shruti}\}$$

$$\text{Range} = \{\text{Catherine, Shanique, Khadija}\}$$

The correspondence **is** a function, because every element of the domain maps to exactly one element of the range.