Math's -I (September)
GA Answers

1) Which of the following are irrational numbers?

- [ ] 2.99999999
- [x] $(\sqrt{8}+\sqrt{2})(\sqrt{12}-\sqrt{3})$
- [x] $\dfrac{\sqrt{6}}{\sqrt{8}}$
- [ ] $(\sqrt{8}-\sqrt{2})(\sqrt{18}+\sqrt{2})$

2) Suppose $f : D \longrightarrow \mathbb{R}$ is a function defined by $f(x) = \dfrac{\sqrt{x^2-25}}{x+5}$, where $D \subset \mathbb{R}$. Let A be the set of integers which are not in the domain of f, then find the cardinality of the set A.

9

3) Consider the set $S = \{a \mid a \in \mathbb{N},\ a \leq 33\}$. Let R_1 and R_2 be relations from S to S defined as $R_1 = \{(x, y) \mid x, y \in S,\ y = 3x\}$ and $R_2 = \{(x, y) \mid x, y \in S,\ y = x^2\}$. Find the cardinality of the set $R_1 \setminus (R_1 \cap R_2)$.

10

4) In a Zoo, there are 6 Bengal white tigers and 9 Bengal royal tigers. Out of these tigers, 5 are males and 10 are either Bengal royal tigers or males. Find the number of female Bengal white tigers in the Zoo.

5

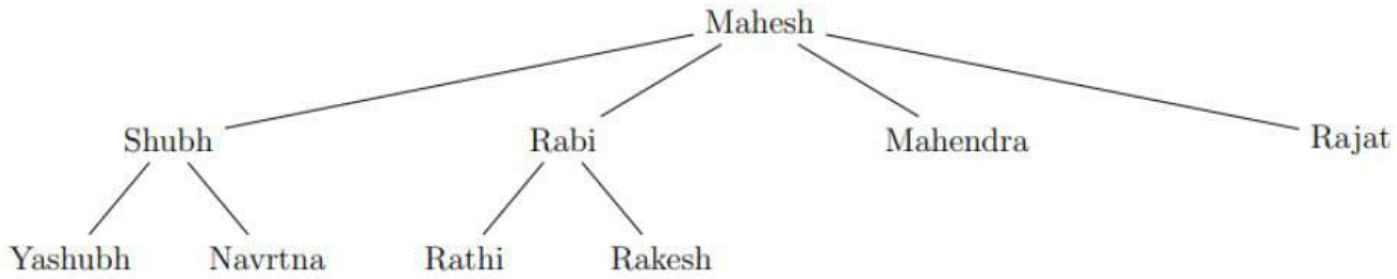
5) Consider the relation $R = \{(x, y) \mid x - y = 0\} \subset \mathbb{R} \times \mathbb{R}$ on the set $\mathbb{R}$. Which of the following is/are true?

- [x] R is a transitive relation.
- [ ] R is a function.
- [ ] R is not an equivalence relation.
- [x] R is a reflexive relation.
- [x] R is a symmetric relation.

6) Mahesh has four sons (Shubh, Rabi, Mahendra, and Rajat). Shubh has two sons (Yashubh and Navrtna). Rabi has two sons named Rathi and Rakesh. This family tree is shown in the figure below. Let us define two relations, R and S, on the set M, which is the collection of all family members, as follows,

$R := \{(A, B) \mid A \text{ and } B \text{ are cousins, i.e. their parents are siblings}\}.$

$S := \{(A, B) \mid A \text{ is son of } B\}.$



If m is the cardinality of the set R and n is the cardinality of the set S, then find the value of $m + n$.

16

1 point

7) Mahesh has four sons (Shubh, Rabi, Mahendra, and Rajat). Shubh has two sons (Yashubh and Navrtna). Rabi has two sons named Rathi and Rakesh. This family tree is shown in the figure below. Let us define two relations, R and S, on the set M, which is the collection of all family members, as follows, *1 point*

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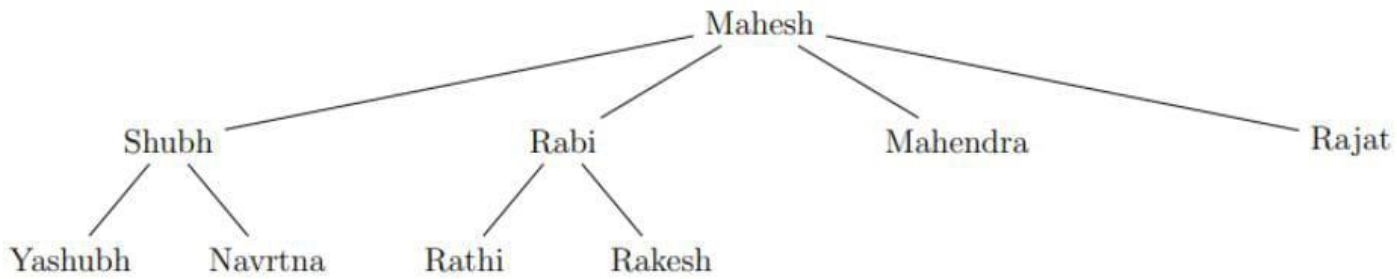

Let $f := \{(A, B) \mid A \text{ is son of } B\} \subset P \times Q$, where P and Q are subsets of M.

Which of the following options are correct?

- [ ] $f : P \to Q$ is a function, where $P = \{\text{Yashubh, Navrtna, Rathi, Rakesh, Mahesh}\}$ and $Q = \{\text{ Shubh, Rabi, Mahendra, Rajat}\}$.
- [ ] If $f : P \to Q$ is a function, where $P = \{\text{ Yashubh, Navrtna, Rathi, Rakesh}\}$ and $Q = \{\text{Shubh, Rabi, Mahendra, Rajat}\}$, then f is one-one.
- [x] If $f : P \to Q$ is a function, where $P = \{\text{Yashubh, Navrtna, Rathi, Rakesh}\}$ and $Q = \{\text{ Shubh, Rabi}\}$, then f is onto.
- [x] If $f : P \to Q$ is a function, where $P = \{\text{Yashubh, Rathi}\}$ and $Q = \{\text{Shubh, Rabi}\}$, then f is bijective.

8) Consider the following table of a few materials and their dielectric constant values. ***1 point***

Material	Dielectric constant
Air	1
Vaccum	2
Paper	3
Glass	8
Nerve membrane	7
Silicon	13

We can think of this as a function f from the set of materials to the set of dielectric constant values consisting of the elements $\{1, 2, 3, 8, 7, 13\}$. Now pick out the correct statement from the following.

- ○ f is neither one to one nor onto.
- ◉ f is one to one but not onto.
- ○ f is onto but not one to one.
- ○ f is bijective.

9) A group of 180 people watched movies on Netflix, of which 95 watched Dabangg, 100 watched Avatar, and 100 watched RRR. 50 people watched Dabangg and Avatar, 40 watched Avatar and RRR, and 55 watched Dabangg and RRR. Find the number of people who watched only RRR and Avatar.

55

10) Define a function $f : \mathbb{Q} \to \mathbb{Z}$, such that $f(p/q) = p - q$, where $gcd(p, q) = 1$. Which of the following option(s) is(are) true?

- ☐ f is one to one but not onto
- ☐ f is neither one to one nor onto.
- ☑ f is onto but not one to one.
- ☐ f is a bijective function.

Yes, the answer is correct.

Score: 1

Accepted Answers:

f is onto but not one to one.

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