Indian Institute of Technology, Madras - BS in Data Science and Applications

Notations :

1.Options shown in green color and with ✔ icon are correct.

2.Options shown in red color and with ✖ icon are incorrect.

Question Paper Name :	IIT M FOUNDATION AN4 EXAM QPF4 16 JULY 2023
Subject Name :	2023 July: IIT M FOUNDATION AN4 EXAM QPF4
Creation Date :	2023-07-10 18:54:05
Duration :	240
Total Marks :	705
Display Marks:	Yes
Share Answer Key With Delivery Engine :	Yes
Actual Answer Key :	Yes
Calculator :	Scientific
Magnifying Glass Required? :	No
Ruler Required? :	No
Eraser Required? :	No
Scratch Pad Required? :	No
Rough Sketch/Notepad Required? :	No
Protractor Required? :	No
Show Watermark on Console? :	Yes
Highlighter :	No
Auto Save on Console?	Yes
Change Font Color :	No

Question Number : 57 Question Id : 640653577484 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1

Question Label : Multiple Choice Question

Which among the following expressions would complete blank (v)?

Options :

6406531928564. ✔ Speak up

6406531928565. ✖ Speak out

6406531928566. ✖ Call back

Sem1 Maths1

Section Id :	64065339053
Section Number :	3
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	12
Number of Questions to be attempted :	12
Section Marks :	50
Display Number Panel :	Yes
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	64065382469
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Number : 58 Question Id : 640653577485 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 0

Question Label : Multiple Choice Question

THIS IS QUESTION PAPER FOR THE SUBJECT "FOUNDATION LEVEL : SEMESTER 1: MATHEMATICS FOR DATA SCIENCE I (COMPUTER BASED EXAM)"

ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?
CROSS CHECK YOUR HALL TICKET TO CONFIRM THE SUBJECTS TO BE WRITTEN.

(IF IT IS NOT THE CORRECT SUBJECT, PLS CHECK THE SECTION AT THE TOP FOR THE SUBJECTS REGISTERED BY YOU)

Options :

6406531928567. ✔ YES

6406531928568. ✖ NO

Question Number : 59 Question Id : 640653577486 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 0

Question Label : Multiple Choice Question

Instructions:

- There are some questions which have functions with discrete valued domains (such as day, month, year etc).
- For NAT type question, enter only one right answer even if you get multiple answers for that particular question.
- Notations:
  - $\mathbb{R}$= Set of real numbers
  - $\mathbb{Q}$= Set of rational numbers
  - $\mathbb{Z}$= Set of integers
  - $\mathbb{N}$= Set of natural numbers
- The set of natural numbers includes 0.

Options :

6406531928569. ✔ Useful Data has been mentioned above.

6406531928570. ✖ This data attachment is just for a reference & not for an evaluation.

Sub-Section Number :	2
Sub-Section Id :	64065382470
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653577487 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (60 to 62)

Question Label : Comprehension

Let $S = \{\text{Jan, Feb, March, April, May}\}$ be a set of months of a particular year. Consider the following relations on the set S.

- $R_1 = \{$ (Feb, Feb), (March, April), (April, March), (March, March) $\}$
- $R_2 = \{$ (Jan, Jan), (Feb, Feb), (March, March), (April, April), (May, May) $\}$

From the below list of given terms find out the best possible options for each of the given subquestions:

1) Reflexive relation
2) Symmetric relation
3) Transitive relation
4) Not a equivalence relation
5) Not a function
6) Injective (One-one) function
7) Surjective (Onto) Function

Sub questions

Question Number : 60 Question Id : 640653577488 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

R_1 is _____ . (Enter all correct options. Enter only the serial numbers of those options in increasing order without adding any comma or space in between them i.e., if your answer is 6 and 7, then you should enter 67]

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

245

Question Number : 61 Question Id : 640653577489 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

R_2 is _____ . (Enter all correct options. Enter only the serial numbers of those options in increasing order without adding any comma or space in between them i.e., if your answer is 3 and 4, then you should enter 34)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

12367

Question Number : 62 Question Id : 640653577490 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

Find the cardinality of the set $(S \times S) \setminus R_2$.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

20

Sub-Section Number :	3
Sub-Section Id :	64065382471
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 63 Question Id : 640653577497 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 5

Question Label : Multiple Choice Question

Consider a polynomial $p(x) = 0.3x^3(x^2 - 1)(x - 2)^2(x - 3)$

Which of the figure represents the polynomial $p(x)$?

Options :

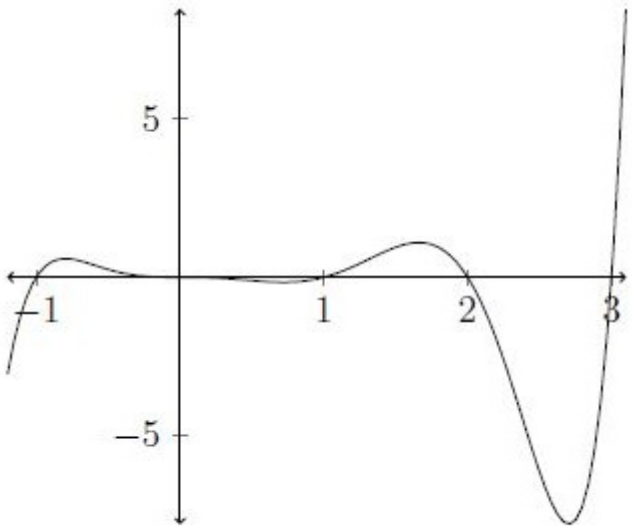

Figure 1

6406531928582. ✖

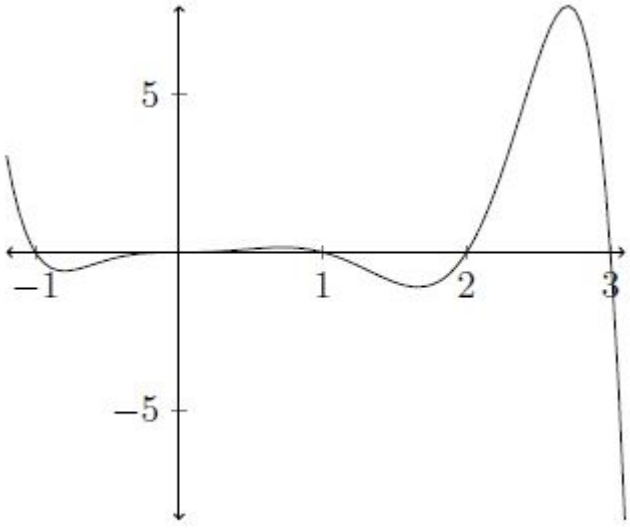

Figure 2

6406531928583. ✖

6406531928584. ✔

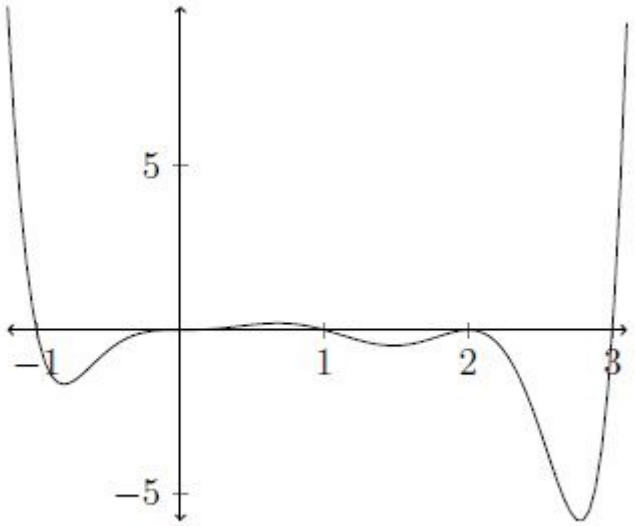

Figure 3

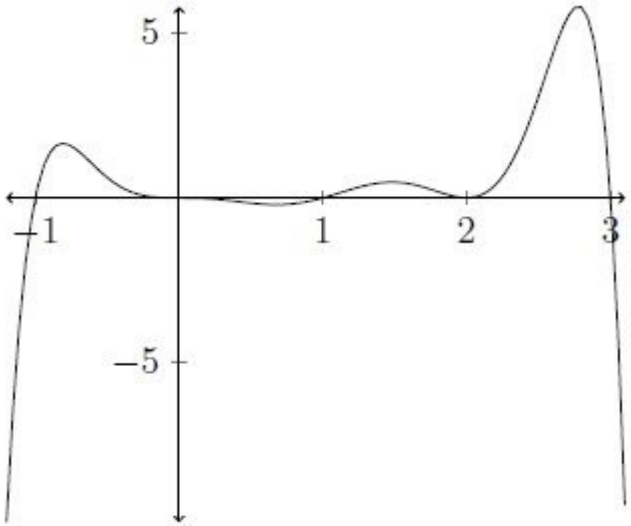

Figure 4

6406531928585.

Sub-Section Number : 4

Sub-Section Id : 64065382472

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 64 Question Id : 640653577496 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following options is/are true?

Options :

6406531928578. ✖ If m and n are $x-$ intercept and $y-$ intercept of the line $2x+3y=6$, respectively, then $m+n=6$

6406531928579. ✖ The $y-$ intercept of a line is the perpendicular distance to the line from the origin.

6406531928580. ✔ The lines $2x+3y=6$ and $3x-2y=6$ are perpendicular to each other.

6406531928581. ✔ The distance between two parallel lines $2x+3y=6$ and $4x+6y=12$ is 0.

Sub-Section Number :	5
Sub-Section Id :	64065382473
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 65 Question Id : 640653577503 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 5 Max. Selectable Options : 0

Question Label : Multiple Select Question

Consider two polynomials $p(x) = x^4 + 3x^3 - 9x + 8$ and $q(x) = (x^2 + x)(x + 3)$. Let $r(x)$ be the remainder obtained when $p(x)$ is divided by $q(x)$. Let $l(x)$ be the line that passes through the $y-$ intercept and the minimum point in the graph of $r(x)$, for reference follow the Figure: M1Q1-1.

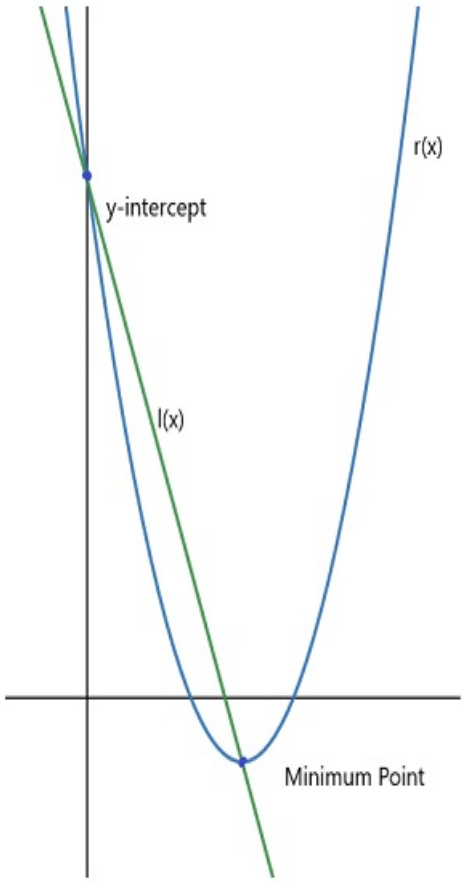

Figure: M1Q1-1

Which of the following options is/are true?

Options :

6406531928593. ✖ $r(x) = x^2 - 6x + 9$

6406531928594. ✔ $l(x) \equiv y = -3x + 8$

6406531928595. ✖ $l(x) \equiv y = -2x + 8$

6406531928596. ✔ The number of turning points in $q(x)$ is 2

Sub-Section Number : 6

Sub-Section Id :	64065382474
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 66 Question Id : 640653577491 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 5

Question Label : Short Answer Question

A company opened recruitment for the post of data analyst. 500 candidates have applied for the post. 285 candidates are proficient in Python programming, 195 candidates are proficient in *C* programming, 115 candidates are proficient in Java programming, 45 candidates are proficient in Python and Java, 70 candidates are proficient in *C* and Python, 50 candidates are proficient in *C* and Java and 50 candidates don't know any of the programming languages. Find the number of candidates who are proficient in exactly one of the three programming languages.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

325

Question Number : 67 Question Id : 640653577495 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 5

Question Label : Short Answer Question

Consider the points $A(0,3), B(x,y), C(4,3), D(1,0)$ and $E(3,1)$ in the coordinate system. Suppose the point B divides internally the line segment AC in the ratio $k:1$. If the area of triangle DEB is 2, then find the positive value of k.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

3

Question Number : 68 Question Id : 640653577502 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 5

Question Label : Short Answer Question

Suppose the line $y = 2x + k$ is the best fit line using SSE for the data set given in Table: 1 for some $k \in \mathbb{R}$.

x	1	2	-1	0
y	2	3	-3	-1

Table: 1

Find the value of $16k$.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

-12

Sub-Section Number :	7
Sub-Section Id :	64065382475
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 69 Question Id : 640653577501 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

Consider a quadratic function $q(x) = ax^2 + bx + c$, where $a, b, c \in \mathbb{R}$ and $a \neq 0$ with the following information:

- The Maximum value attained by $q(x)$ is at $x = -1$.
- Discriminant value of $q(x)$ is 8.
- Slope of the function at $x = 1$ is 8.

Find the value $q(2)$.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

17

Sub-Section Number :	8
Sub-Section Id :	64065382476
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653577492 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (70 to 71)

Question Label : Comprehension

A company's profit function, given by $P(x) = -2x^2 + 8x - 6$, represents the relationship between the quantity (x) of the raw material used in the manufacturing process and the resulting profit. Use this information to answer the given subquestions.

Sub questions

Question Number : 70 Question Id : 640653577493 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

Find the quantity of the raw material such that the company has the maximum profit.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

2

Question Number : 71 Question Id : 640653577494 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 2

Question Label : Short Answer Question

Find the quantity of the raw material ($x > 1$) such that the company has no profit.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

3

Sub-Section Number :	9
Sub-Section Id :	64065382477
Question Shuffling Allowed :	No
Is Section Default? :	null

Question Id : 640653577498 Question Type : COMPREHENSION Sub Question Shuffling Allowed : No Group Comprehension Questions : No Question Pattern Type : NonMatrix Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Question Numbers : (72 to 73)

Question Label : Comprehension

Consider a polynomial $p(x) = (x^2 - 1)(x^3 - 4x^2 + 4x)$ $(x^3 - 10x^2 + 33x - 36)$ such that

- $t(x) = (x^3 - 6x^2 + 9x)$ divides $p(x)$.
- $s(x) = (x^2 - 5x + 4)$ divides $p(x)$.
- $q(x)$ is the quotient when $p(x)$ is divided by the polynomial $z(x) = (x + 1)t(x)s(x)$

Use this information to answer the given subquestions:

Sub questions

Question Number : 72 Question Id : 640653577499 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

If *m* is the number of distinct roots and *n* is the number of turning points of the polynomial *p*(*x*), then find the value of *m* + *n*

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

13

Question Number : 73 Question Id : 640653577500 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 4 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following options is/are true?

Options :

6406531928587. ✔ The Minimum value of the quotient $q(x)$ is 0.

6406531928588. ✖ $p(x)$ is an odd degree polynomial.

6406531928589. ✔ End behavior $p(x) \to +\infty$ as $x \to +\infty$

6406531928590. ✔ End behavior $p(x) \to +\infty$ as $x \to -\infty$

Sem1 Statistics1

Section Id :	64065339054
Section Number :	4
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
Number of Questions to be attempted :	10
Section Marks :	40
Display Number Panel :	Yes
Group All Questions :	No
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	64065382478