Q#	SUGGESTED ANSWER	DESCRIPTORS	Total Marks

QUESTION 1 [13 marks]

Q#	SUGGESTED ANSWER	DESCRIPTORS	Total Marks
1.1.1	3,6,9,12 ✓	1mark for all four	
1.1.2	3 and 10 ✓	1mark for both	
1.1.3	3 ✓	1mark for answer	
1.1.4	3 ✓	1mark for answer	
1.1.5	17 ✓	1mark for answer	5

1.2.1

2	72
2	36
2	18
3	9
3	3
	1

✓

$= 2 \times 2 \times 2 \times 3 \times 3$ ✓
$= 2^3 \times 3^2$ ✓

1 mark for method
1 mark for expansion
1 mark for answer   3

1.2.2

2	24
2	12
2	6
3	3
	1

2	32
2	16
2	8
2	4
2	2
	1

$= 2 \times 2 \times 2 \times 3$ ✓ $= 2 \times 2 \times 2 \times 2 \times 2$ ✓

LCM = 96 ✓

OR

M_{24} : 24; 48; 72; 96; 120;..... ✓
M_{32}: 32; 64; 96 ✓

LCM = 96 ✓

OR

Factor tree

1 mark for each prime factorization
1 mark for answer

1 mark for each set of multiples

1 mark for answer   3

1.2.3

$3,45 \times 10^8$ ✓✓

1 mark for decimal comma
1 mark for exponent   2

Mathematics P1 2015 June Memorandum

S. V. Ivanov

Mathematics P1 2015 June Memorandum:

   Antenna Theory Constantine A. Balanis,2016-02-01 Updated with color and gray scale illustrations a companion website housing supplementary material and new sections covering recent developments in antenna analysis and design This book introduces the fundamental principles of antenna theory and explains how to apply them to the analysis design and measurements of antennas Due to the variety of methods of analysis and design and the different antenna structures available the applications covered in this book are made to some of the most basic and practical antenna configurations Among these antenna configurations are linear dipoles loops arrays broadband antennas aperture antennas horns microstrip antennas and reflector antennas The text contains sufficient mathematical detail to enable undergraduate and beginning graduate students in electrical engineering and physics to follow the flow of analysis and design Readers should have a basic knowledge of undergraduate electromagnetic theory including Maxwell s equations and the wave equation introductory physics and differential and integral calculus Presents new sections on flexible and conformal bowtie Vivaldi antenna antenna miniaturization antennas for mobile communications dielectric resonator antennas and scale modeling Provides color and gray scale figures and illustrations to better depict antenna radiation characteristics Includes access to a companion website housing MATLAB programs Java based applets and animations Power Point notes Java based interactive questionnaires and a solutions manual for instructors Introduces over 100 additional end of chapter problems Antenna Theory Analysis and Design Fourth Edition is designed to meet the needs of senior undergraduate and beginning graduate level students in electrical engineering and physics as well as practicing engineers and antenna designers Constantine A Balanis received his BSEE degree from the Virginia Tech in 1964 his MEE degree from the University of Virginia in 1966 his PhD in Electrical Engineering from The Ohio State University in 1969 and an Honorary Doctorate from the Aristotle University of Thessaloniki in 2004 From 1964 to 1970 he was with the NASA Langley Research Center in Hampton VA and from 1970 to 1983 he was with the Department of Electrical Engineering of West Virginia University In 1983 he joined Arizona State University and is now Regents Professor of Electrical Engineering Dr Balanis is also a life fellow of the IEEE *Interpolation for Normal Bundles of General Curves* Atanas Atanasov,Eric Larson,David Yang,2019-02-21 Given n general points p1 p2 pn Pr it is natural to ask when there exists a curve C Pr of degree d and genus g passing through p1 p2 pn In this paper the authors give a complete answer to this question for curves C with nonspecial hyperplane section This result is a consequence of our main theorem which states that the normal bundle NC of a general nonspecial curve of degree d and genus g in Pr with d g r has the property of interpolation i e that for a general effective divisor D of any degree on C either H0 NC D 0 or H1 NC D 0 with exactly three exceptions **The Bounded and Precise Word Problems for Presentations of Groups** S. V. Ivanov,2020-05-13 The author introduces and studies the bounded word problem and the precise word problem for groups given by means of generators and defining relations For example for every finitely presented group the bounded word

problem is in NP i e it can be solved in nondeterministic polynomial time and the precise word problem is in PSPACE i e it can be solved in polynomial space The main technical result of the paper states that for certain finite presentations of groups which include the Baumslag Solitar one relator groups and free products of cyclic groups the bounded word problem and the precise word problem can be solved in polylogarithmic space As consequences of developed techniques that can be described as calculus of brackets the author obtains polylogarithmic space bounds for the computational complexity of the diagram problem for free groups for the width problem for elements of free groups and for computation of the area defined by polygonal singular closed curves in the plane The author also obtains polynomial time bounds for these problems

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