MATHEMATICS

MATHEMATICS

XI

General and subject-specific guidelines

1. The course content for Class XI will be the same as prescribed in the core syllabus in Mathematics (Sr. secondary stage) brought out by the Council of Boards of School Education in India. (COBSE) in collaboration with NCERT.

2. The individual boards are free to change the weightage as per their local-specific need and requirement. It is suggested that variation may not exceed 10 per cent.

3. The primary purpose of the board examination is to find out what and how much student know, not what and how much they don't know.

4. For designing a good question paper, a paper setter should combine his/her knowledge of the subject with an adequate understanding of the techniques of paper setting judiciously.

Subject-specific

5. The language of the question paper should be simple and clear, so that every question carries the same meaning for all students. Its translated version must convey the same meaning as the English version.
   S.I. units and standard mathematical symbols used in the textbook should be used.

6. Question paper must cover the entire syllabus, as shown in the blue print and design.

7. In multiple choice questions, all the options should be so designed such that guess work can be minimized.

8. Questions of the type true-false/fill in the blanks/ matching type should be avoided.

9. Questions involving long calculations requiring calculators should be avoided.

10. The question paper should be so designed that an average student must be able to complete it in the given time.

Subject: Mathematics **Class:** XI

Total Marks: 100 **Time:** 3 hrs

Maximum marks: 100

Weighting to assessment of objectives

Objective	Marks	Percentage
Knowledge	30	30
Understanding	40	40
Application	22	22
Skill (Drawing of sketches etc.)	8	8
TOTAL		**100**

Subject: Mathematics **Class:** XI

Total Marks: 100 **Time:** 3 hrs

Maximum marks: 100

Weighting to forms / types of questions

Form/type of questions	Marks for each question	Total No. of questions	Total marks
Long answer	30%	5	30
Short answer	52%	13	52
Very short answer	12%	6	12
Objective (MCQ)	6%	6	6
TOTAL	100%	**30**	**100**

Subject: Mathematics **Class:** XI

Total Marks: 100 **Time:** 3hrs

Maximum marks: 100

Weighting to difficulty level of questions

Estimated level	Marks	Percentage of marks
Difficult	20	20
Average	50	50
Easy	30	30
TOTAL	**100**	**100**

Subject: Mathematics **Class: XI**
Total Marks: 100 **Time: 3hrs**

Design

Unit-wise time and marks distribution

Unit	Chapters	Expected periods	Numbers of questions	Marks allotted	Time (in minutes)
I	• Sets • Relations and Functions • Trigonometric functions	12 14 44 18	LA 1 SA 2 VSA 3 MCQ 1	6 8 21 6 1	35
II	Principle of mathematical induction Complex numbers and Quadratic equations • Linear Inequalities • Permutations and combinations • Binomial Theorem • Sequences and series	06 10 10 56 12 08 10	LA 2 SA 5 VSA 1 MCQ 2	12 20 36 2 2	60
III	• Straight lines • Conic sections • Introduction to 3-D geometry	09 12 29 08	LA 1 SA 3 VSA - MCQ 2	6 12 20 - 2	33
IV	• Limits and Derivatives	18	LA - SA 1 VSA 1 MCQ -	- 4 6 2 -	9
V	• Mathematical reasoning	08	LA - SA 1 VSA - MCQ -	- 4 4 - -	6
VI	• Statistics • Probability	10 25 15	LA 1 SA 1 VSA 1 MCQ 1	6 4 13 2 1	22
	TOTAL	**180**	**30**	**100**	**165 +15 for reading and revision**

Subject: Mathematics Class XI
Total Marks: 100 Time: 3hrs

Blue Print

Assessment Objectives and Distribution of Forms of Questions

	UNIT	KNOWLEDGE				UNDERSTANDING				APPLICATION				SKILLS				
		LA	SA	VSA	Objective	LA	SA	VSA	Objective	LA	SA	VSA	Objective	LA	SA	VSA	Objective	
Set and Functions	I		1		1		1	1		1						2		21
Algebra	II	1			2		3	1		1	1				1			36
Coordinate Geometry	III				2		3			1								20
Calculus	IV		1					1										6
Maths Reasoning	V		1															4
Statistics and Probability	VI	1			1		1	1										13
Marks		**12**	**12**		**6**		**32**	**8**		**18**	**4**				**4**	**4**		
Total Marks		**30**				**40**				**22**				**8**				

The above Blue- print is based on the given design. The sample question paper has been prepared on the basis of the Blue-print.
Having the same design, different blue-prints and based question papers can be developed.

SAMPLE QUESTION PAPER
CLASS – XI
MATHEMATICS

General Instructions
Time Allowed: 3 Hours **Maximum**
marks: 100

1. All questions are compulsory.
2. The question paper consists of 30 questions divided into four sections A, B, C and D.
3. Section A contains 6 questions of 1 mark each, which are multiple choice type questions. Section B contains 6 questions of 2 marks each, Section C contains 13 questions of 4 marks each and Section D contains 5 questions of 6 marks each.
4. There is no overall choice in the paper. However, internal choice is provided in one questions of 2 marks, three questions of 4 marks each and one questions of 6 marks each. In questions with choices, only one of the choices is to be attempted.
5. Use of calculators is not permitted.

Section – A

Question numbers 1 to 6 carry 1 mark each. *In each question, four options are provided, out of which only one is correct. Select the correct option.*

1. The Set $A = \{x : x \in R, -4 \leq x < 9\}$ written as an interval is
   (A) $[-4, 9]$ (B) $(-4, -9)$ (C) $[-4, 9)$ (D) $(-4, 9]$

2. If $\left[\frac{1+i}{1-i}\right]^x = 1$ and n is any natural number then the value of x is
   (A) 2n + 1 (B) 4n (C) 4n + 1 (D) 2n − 1

3. The co-efficient of middle term in the expansion of $(1-x)^6$ is:
   (A) ${}^6C_3$ (B) $-{}^6C_3$ (C) ${}^6C_4$ (D) $-{}^6C_4$

4. The length of the major axis of the ellipse $2x^2 + 3y^2 = 6$ is
   (A) $2\sqrt{2}$ (B) $2\sqrt{3}$ (C) $\sqrt{6}$ (D) $\sqrt{3}$

5. The positive value of k for which the distance between the points P (3, −2, 4) and Q (5, 3, k) is $3\sqrt{6}$ units, is
   (A) 1 (B) 5 (C) 4 (D) 9

6. A card is drawn at random from a well shuffled pack of playing cards. The probability of getting a king or a red card is
   (A) $\frac{17}{52}$ (B) $\frac{4}{3}$ (C) $\frac{7}{13}$ (D) $\frac{15}{26}$

Section – B

Question numbers 7 to 12 carry two marks each.

7. Draw the graph of the function $f(x) = |2x - 1|, x \in R$.

8. Find the domain and range of the function $g(x) = \frac{1}{(x^2 - 2x)}$

9. Draw the graph of $f(x) = \cos 2x, -\pi \leq x \leq \pi$

10. The product of three numbers in AP is 1155, and the largest number is 1 more than twice the smallest number. Find the numbers.

11. Evaluate : $\lim_{x \to 0} \frac{\sin ax + bx}{ax + \sin bx}$ $\quad a, b, a+b \neq 0$

12. The variance of 20 observations is 5. If each observation is multiplied by 2, find the new variance of the resulting observations.

OR

The mean and variance of eight observations are 9 and 9.25 respectively. If six of the observations are 6,7,10,12,12 and 13, find the remaining two observations.

Section – C

Question numbers 13 to 25 carry 4 marks each.

13. Give A= {1,2,3,4}, B = {3,4,5,6,} and C = {1,3,5}
Verify that $A - (B \cup C) = (A-B) \cap (A-C)$

14. If in a triangle ABC, acosA = bcosB, prove that either the triangle is isosceles or right angled.

OR

If $\tan x = \frac{3}{4}, \pi < x < \frac{3\pi}{2}$, find the value of the $\tan\frac{x}{2}$.

15. Find the value of $\theta \in R$ such that $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely real.

OR

Solve for x: $2x^2 - (3+7i)x + (9i-3) = 0$

16. Solve the following system of inequalities graphically:

$2x + y \geq 4,\ x + y \leq 3, 2x - 3y \leq 6$

17. In how many ways 5 girls and 4 boys can be seated in a row, so that no two boys are together?

18. If ${}^{n}C_{r} : {}^{n}C_{r+1} = 1:2$ and ${}^{n}C_{r+1} : {}^{n}C_{r+2} = 2:3$, find n and r.

19. Determine whether the expansion of $\left(x^2 - \frac{2}{x}\right)^{18}$ will contain a term containing x^{10} ?

OR

Find numerically the greatest term in the expansion of $(2+3x)^9$, where $x = \frac{3}{2}$.

20. If p and q are the lengths of perpendiculars from the origin to the lines $x\cos\theta - y\sin\theta = k\cos 2\theta$ and $x\sec\theta + y\operatorname{cosec}\theta = k$, respectively, prove that $p^2 + 4q^2 = k^2$.

21. A circle of radius 2 units lies in the first quadrant and touches both the axes. Find the equation of another circle with centre at (6, 5) and touching the first circle externally.

22. A point R with x coordinate 4, lies on the line segment joining the points P (2, -3, 4) and Q (8, 0, 10). Find the coordinates of the point R.

23. Using first principle, find the derivative of $\cos(2x+3)$ w.r.t. x.

24. Check whether the following statement is true or not: If $x, y \in Z$ (the set of integers) are such that x and y are odd, then xy is odd.

25. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that both will not qualify the examination.

Section-D

Question numbers 26 to 30 carry 6 marks each.

26. Prove that

$$\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$$

27. Using the Principle of Mathematical Induction, prove that $3^{2n+2} - 8n - 9$ is divisible by 8, for all $n \in N$.

OR

Prove the following by using the Principle of Mathematical Induction for all $n \in N$

$$1+\frac{1}{(1+2)}+\frac{1}{(1+2+3)}+ \text{----------} +\frac{1}{(1+2+3+....+n)}=\frac{2n}{n+1}$$

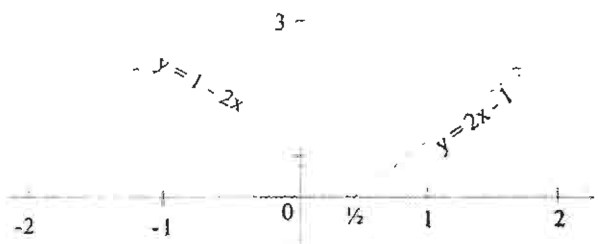
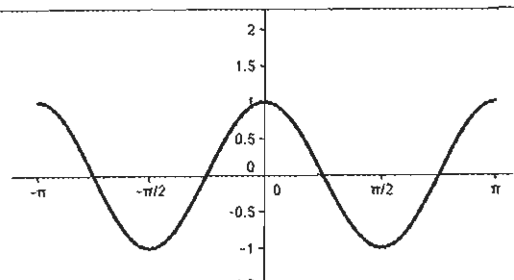
28. If a and b are the roots of $x^2-3x+p=0$ and c and d are the roots of $x^2-12x+q=0$, where a, b, c, d form a GP, prove that $(q+p):(q-p)=17:15$.

29. A person standing at the crossing of two straight paths represented by the equations $2x-3y+4=0$ and $3x+4y-5=0$ wants to reach the path whose equation is $6x-7y+8=0$ in the least time. Find the equation of the path he should follow.

30. Calculate the mean and standard deviation of the following distribution:

Classes	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	15	40	20	15	5	5

Sample paper (Marking Scheme)
Class XI Maths
SECTION – A

Q. No.	Value points and solution	Marks
1 – 6	1. (C), 2. (B) 3. (B). 4. (B) 5. (D) 6. (C)	1×6 = 6
7	**SECTION – B**  (Correct Graph)	1
	$\lvert 2x-1\rvert \begin{cases} = 2x-1, & x > \frac{1}{2} \\ = 0, & x = \frac{1}{2} \\ = 1-2x, & x < \frac{1}{2} \end{cases}$	1
8	$g(x) = \frac{1}{x^2-2x} = \frac{1}{x(x-2)} \Rightarrow \text{domain} : R - \{0, 2\}$	1
	$\text{Range} : (-\infty, -1) \cup (0, \infty)$	1
9		2
10	Let the three numbers be a-d, a, a+d	
	$\Rightarrow \quad a(a-d)(a+d) = 1155$ ....(1)	½
	And $\quad a+d = 2(a-d)+1 \text{ or } a = 3d-1$	½
	(1) $\quad \Rightarrow (2d-1)(3d-1)(4d-1) = (7)(11)(15)$	½
	$\Rightarrow \quad d = 4 \text{ and } a = 11$	½
	$\Rightarrow \quad \text{Numbers are} : 7, 11, 15$	

11	$\lim\limits_{x\to 0} \dfrac{\sin ax + bx}{ax + \sin bx} = \lim\limits_{x\to 0} \dfrac{a\dfrac{\sin ax}{ax} + b}{a + b\dfrac{\sin bx}{bx}}$ $= \dfrac{a+b}{a+b} = 1$	1 1
12	$\dfrac{\Sigma x_i^2}{20} - \left(\dfrac{\Sigma x_i}{20}\right)^2 = 5$ New $\Sigma x'_i = \Sigma(2x_i) = 2\Sigma x_i$ $\Sigma x'^2_i = \Sigma(2x_i)^2 = 4\Sigma x_i^2$ New variance : $\dfrac{\Sigma x'^2_i}{20} - \left(\dfrac{\Sigma x'_i}{20}\right)^2 = \dfrac{4\Sigma x_i^2}{20} - 4\left(\dfrac{\Sigma x_i}{20}\right)^2 = 4(5) = 20$ **OR** Let two numbers be x and y $\Rightarrow \dfrac{6+7+10+12+12+13+x+y}{8} = 9$ $\Rightarrow x + y = 72 - 60 = 12$ ....(i) $\Rightarrow \dfrac{36+49+100+144+144+169+x^2+y^2}{8} = 9^2 = 9.25$ $\Rightarrow x^2 + y^2 = 80$ ....(ii) Solving (i) and (ii) to get x = 4, y = 8	 ½ ½ 1 ½ ½ 1
13	$BUC = \{1,3,4,5,6\} \quad \Rightarrow A - (BUC) = \{2\}$ $A - B = \{1,2\} \quad A - C = \{2,4\}$ $\Rightarrow (A-B)\cap(A-C) = \{2\}$ Hence proved.	1 1+1 1
14	$a\cos A = b\cos B \quad \Rightarrow \cancel{k}.\sin A\cos A = \cancel{k}.\sin B\cos B$ $\Rightarrow \sin 2A = \sin 2B \quad \Rightarrow 2A = n\pi + (-1)^n.2B$ $A = n\dfrac{\pi}{2} + (-1)^n B$ for $n = 0$ $A = B$ and for $n = 1$ $\Rightarrow A + B = \dfrac{\pi}{2} \Rightarrow \angle C = 90^0$ **OR**	½ 1 ½ 1+1

<table>
<tr>
<td></td>
<td>$\tan x = \frac{3}{4} \Rightarrow \cos x = -\frac{4}{5}$

$\tan\frac{x}{2} = -\sqrt{\frac{1-\cos x}{1+\cos x}} = -\sqrt{\frac{1+\frac{4}{5}}{1-\frac{4}{5}}}$

$\{\because \frac{x}{2}$ lies in 2^{nd} quadrant$\}$

$= -\sqrt{\frac{9}{1}} = -3$</td>
<td>1

1+1

1</td>
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<tr>
<td>15</td>
<td>$z = \frac{3+2i\sin\theta}{1-2i\sin\theta} \times \frac{1+2i\sin\theta}{1+2i\sin\theta} = \frac{(3-4\sin^2\theta)+i(8\sin\theta)}{1+4\sin^2\theta}$
∴ If z is purely real, $\sin\theta = 0 \Rightarrow \theta = n\pi$
OR

$x = \frac{(3+7i) \pm \sqrt{(3+7i)^2 - 8(9i-3)}}{4}$ ....(i)
$\sqrt{(3+7i)^2 - 8(9i-3)} = \sqrt{-16-30i} = a+ib, \quad a,b \in R$
Finding $a \pm 3$ and $b = \pm 5$
(i) $\Rightarrow \quad x = \frac{(3+7i)\pm(3-5i)}{4} = \frac{3}{2} + \frac{1}{2}i$ or $3i$</td>
<td>2

1+1

1

1

1+1</td>
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<tr>
<td>16</td>
<td>$2x + y \geq 4$ for $2x + y = 4$
<table><tr><td>x</td><td>0</td><td>2</td><td>1</td></tr><tr><td>y</td><td>4</td><td>0</td><td>2</td></tr></table>
$x + y \leq 3$, let $x + y = 3$
<table><tr><td>x</td><td>0</td><td>3</td><td>1</td></tr><tr><td>y</td><td>3</td><td>0</td><td>2</td></tr></table>
$2x - 3y \leq 6$, let $2x - 3y = 6$
<table><tr><td>x</td><td>0</td><td>3</td><td>-3</td></tr><tr><td>y</td><td>-2</td><td>0</td><td>-4</td></tr></table></td>
<td>½

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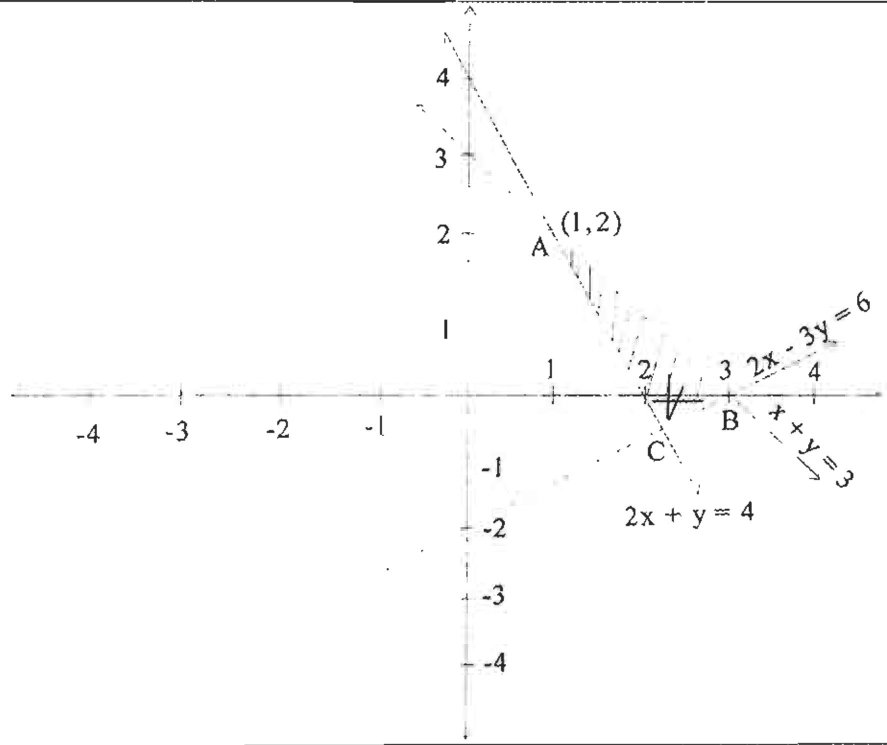
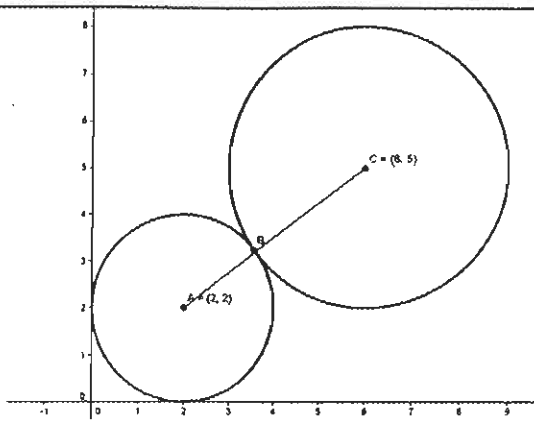
	 	2½
17	5 girls can sit in 5! = 120 ways In between girls, there are 6 places $\therefore$ Boys can sit in ${}^6P_4 = \frac{6!}{2!} = 360$ ways $\therefore$ Total no. of ways = 120 × 360 = 43200	1 1 1 1
18	$2.{}^nC_r = 1.{}^nC_{r+1} \Rightarrow 2.\frac{n!}{(n-r)!r!} = \frac{n!}{(n-r-1)!(r+1)!}$ $\Rightarrow \frac{2}{n-r} = \frac{1}{r+1} \Rightarrow n-3r-2=0$ ....(i) $3.{}^nC_{r+1} = 2.{}^nC_{r+2} \Rightarrow \frac{3.n!}{(n-r-1)!(r+1)!} = \frac{2n!}{(n-r-2)!(r+2)!}$ $3(r+2) = 2(n-r-1) \Rightarrow 2n-5r-8=0$ ....(ii) Solving to get n = 14, r = 4	1 1 1 1
19	For $\left(x^2 - \frac{2}{x}\right)^{18}$, $T_{r+1} = {}^{18}C_r(x^2)^{18-r}.\left(\frac{-2}{x}\right)^r$ $= {}^{18}C_r(-2)^r.x^{36-3r}$ For x^{10}, $36-3r=10 \Rightarrow 3r=26 \Rightarrow r=\frac{26}{3}$ $\therefore$ There will be no term containing x^{10}.	1 1 1 1

	OR	
	$(2+3x)^9 = 2^9.\left(1+\frac{3x}{2}\right)^9$	½
	$\frac{T_{r+1}}{T_r} = \frac{2^9\left[{}^9C_r\left(\frac{3x}{2}\right)^r\right]}{2^9\left[{}^9C_{r-1}\left(\frac{3x}{2}\right)^{r-1}\right]} = \frac{\frac{9!}{r!(9-r)!}}{\frac{9!}{(r-1)!(9-r+1)!}}\ \frac{3x}{2}$	1
	$= \frac{9-r+1}{r}.\left(\frac{9}{4}\right) \qquad Q\ x=\frac{3}{2}$	½
	$= \frac{90-9r}{4r}$	1
	$\frac{T_{r+1}}{T_r} \geq 1 \Rightarrow \frac{90-9r}{4r} \geq 1 \ \Rightarrow 90-9r \geq 4r$	
	$r \leq \frac{90}{13}$	1
	$\leq 6\frac{12}{13}$ $\therefore$ For Max. value r = 6 $\Rightarrow T_7 = 2^9.{}^9C_6.\left(\frac{9}{4}\right)^6 = \frac{7\times 3^{13}}{2}$	
20	Here $p = \frac{k\cos 2\theta}{\sqrt{\cos^2\theta+\sin 2\theta}} = k\cos 2\theta$	1
	$q = \frac{k}{\sqrt{\sec^2\theta+\operatorname{cosec}^2\theta}} = k\sin\theta\cos\theta = \frac{k}{2}\sin 2\theta$	1
	$p^2+4q^2 = k^2\cos^2 2\theta + 4.\frac{k^2}{4}\sin^2 2\theta = k^2(\cos^2 2\theta+\sin^2 2\theta)$ $= k^2$	1+1

21	 Centre A is at (2,2) $\Rightarrow \mathrm{AC}=\sqrt{(3)^2+(4)^2}=5$ $\mathrm{BC}=5-2=3$ $\therefore$ Equation of Circle is $(x-6)^2+(y-5)^2=9$	1 1 1 1
22	P R Q (2,-3,4) (4,y,z) (8,0,10) let R divider $\overline{\mathrm{PQ}}$ in k : 1 $\Rightarrow 4=\frac{8\mathrm{k}+2}{\mathrm{k}+1}$ $\Rightarrow 4k+4=8k+2 \Rightarrow 2=4k, \quad k=\frac{1}{2}$ $y=\frac{0.k+(-3)}{k+1}=\frac{-3}{\frac{1}{2}+1}=\frac{-3}{\frac{3}{2}}=-2$ $z=\frac{10k+4}{k+1}=\frac{5+4}{\frac{3}{2}}=\frac{18}{3}=6$ $\Rightarrow R(4,-2,6)$	1 1 1 1
23	$f(x)=\cos(2x+3) \qquad f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{\cos(2x+2h+3)-\cos(2x+3)}{h}$ $=\lim_{h\to 0}\frac{-2\sin\left[\frac{4x+6+2h}{2}\right]\sin h}{h}=-2\sin(2x+3)$	1 2 1

24	Let p: $x, y \in z$ such that x and y are odd $q: xy$ is odd Assume that if p is true, then q is true p is true means $x = 2m+1,\ m \in z$ and $y = 2n+1,\ n \in z$ $xy = (2m+1)(2n+1)$ $= 2(2mn+m+n)+1 \quad \therefore xy$ is odd. $\therefore$ given statement is true. Assume that q is not true. $\therefore \sim q: xy$ is even $\therefore$ either x or y is even $\Rightarrow$ p is not true $\therefore \sim q \Rightarrow \sim p$	1 1 1 1
25	. P(Anil) = 0.05 P(Ashima) = 0.10 P(Anil & Ashima) = 0.02 Let P(E) = 0.05 P(F) = 0.10 $P(E \cap F) = 0.02$ P (both will not qualify) = $P(E' \cap F') = P(E \cup F)' = 1 - P(E \cup F)$ $= 1 - [P(E) + P(F) - P(E \cap F)]$ $= 1 - [0.05 + 0.10 - 0.02]$ $= 1 - [0.15 - 0.02] = 1 - 0.13 = 0.87$	1 1 1 1
26	$LHS = \cos^2 x + \cos^2\left(x+\frac{\pi}{3}\right) + \cos^2\left(x-\frac{\pi}{3}\right)$ $= \frac{1}{2}\left[1+\cos 2x + 1 + \cos\left(2x+\frac{2\pi}{3}\right) + 1 + \cos\left(2x-\frac{2\pi}{3}\right)\right]$ $= \frac{1}{2}\left[3+\cos 2x + 2\cos\left(\frac{2x+\frac{2\pi}{3}+2x-\frac{2\pi}{3}}{2}\right)\cos\left(\frac{2x+\frac{2\pi}{3}-2x+\frac{2\pi}{3}}{2}\right)\right]$ $= \frac{1}{2}\left[3+\cos 2x + 2\cos 2x.\cos(\frac{2\pi}{3})\right]$ $= \frac{1}{2}\left[3+\cos 2x + 2\cos 2x.(-\frac{1}{2})\right] = \frac{3}{2}$	1 1 2 1 1
27	Let P(n): " $3^{2n+2} - 8n - 9$ is divisible by 8" $n = 1 \Rightarrow 3^4 - 8 - 9 = 81 - 17 = 64$ which is divisible by 8 $\Rightarrow$ P(1) is true ....(i)	1

	let P(k) is true $\Rightarrow 3^{2k+2+2}-8k-9=8a,\ \ a\in z$.........................(ii)	1
	$n=k+1\Rightarrow 3^{2k+2+2}-8(k+1)-9$	1
	$=3^2.\ 3^{2k+2}-8k-8-9$	
	$=9[8a+8k+9]-8k-17$	1
	$=72a+72k-8k+81-17$	
	$=72a+64k+64=8(b)\ b\in z$	1
	$\Rightarrow$ P(K+1) is true Hence P(n) is true $\forall\, n\in N$	1
	OR	
	$P(n):1+\frac{1}{1+2}+\frac{1}{1+2+3}+........+\frac{1}{1+2+3+...+n}=\frac{2n}{n+1}$	1
	For n = 1 LHS = 1 RHS = $\frac{2}{2}=1$	
	$\Rightarrow p(1)$ is true ....(i)	1
	Let P(k) be true	
	$\Rightarrow 1+\frac{1}{1+2}+\frac{1}{1+2+3}+.......\frac{1}{1+2+......+k}=\frac{2k}{5+1}$.................(ii)	
	For P(k+1)	1
	LHS $=1+\frac{1}{1+2}+\frac{1}{1+2+3}+.........+\frac{1}{1+2+......+k}+\frac{1}{1+2+......+(k+1)}$	1
	$=\frac{2k}{k+1}+\frac{2}{(k+1)(k+2)}=2\frac{k(k+2)+1}{(k+1)(k+2)}$	1
	$=2\frac{(k+1)^2}{(k+1)(k+2)}=\frac{2(k+1)}{k+1}\Rightarrow$ P(k+1) is true	1
	$\Rightarrow$ P(n) is true $\forall$ n $\in$ N	
28	Here a+b = 3, ab = p, c+d = 12, cd = q	1
	and $\frac{b}{a}=\frac{c}{b}=\frac{d}{c}=k\Rightarrow b=ak, c=ak^2, d=ak^3$	1
	$\frac{c+d}{a+b}=\frac{4}{1}\Rightarrow\frac{ak^2(1+k)}{a(1+k)}=4\Rightarrow k=2$	1
	$\frac{q}{p}=\frac{cd}{ab}\Rightarrow\frac{q+p}{q-p}=\frac{cd+ab}{cd-ab}=\frac{a^2k^5+a^2k}{a^2k^5-a^2k}$	2
	$=\frac{k^4+1}{k-1}=\frac{16+1}{16-1}=\frac{17}{15}$	1
29	Equation of line through the intersection of two given lines is	

$2x-3y+4+k(3k+4y-5)=0$ 1

$or\ (2+3k)x+(-3+4k)y+4-5k=0$ ....(i) 1

$line\,(i)\,is \perp to\ 6x-7y+8=0$

$\Rightarrow +\frac{2+3k}{-3+4k}=+\frac{7}{6} \Rightarrow 12+18k=-21+28k \Rightarrow k=\frac{33}{10}$ 2 1 1

$\therefore$ Putting in (i) we get $119x+102y-125=0$

30

Classes	x_i	Freq.	d_i	f_id_i	$f_id_i^2$
0-10	5	15	-2	-30	60
10-20	15	40	-1	-40	40
20-30	25	20	0	0	0
30-40	35	15	1	15	15
40-50	45	5	2	10	20
50-60	55	5	3	15	45
		100		-30	180

2

Mean = $25-\frac{30}{100}\times 10=25-3=22$ 1

$\sigma^2=100\left(\frac{180}{100}-\left(\frac{3\cancel{0}}{10\cancel{0}}\right)^2\right)=100\left(\frac{180}{100}-\frac{9}{100}\right)=171$ 2

SD = $\sigma=13.08$ 1