DEPARTMENT OF GOVERNMENT EXAMINATIONS, CHENNAI – 600 006

HIGHER SECONDARY FIRST YEAR EXAMINATION - MARCH 2018

MATHEMATICS KEY ANSWER - ENGLISH MEDIUM

GENERAL INSTRUCTIONS

1. The answers given in the marking scheme are taken from TEXT BOOK, and SOLUTION BOOK bound. If a student has given any answer which is different from one given in the marking scheme, but carries the prescribed content meaning (rigorous) such answers should be given full credit with suitable distribution.

2. Follow the foot notes which are given under certain answer schemes.

3. If a particular stage is wrong and if the candidate writes the appropriate formula then award 1 mark for the formula (for the stage mark 2*). This mark is attached with that stage. This is done with the aim that a student who did the problem correctly without writing the formula should not be penalized.

4. In the case of Section II, III, and IV, if the solution is correct then award full mark directly. The stage mark is essential only if the part of the solution is incorrect.

Answers written only in Black and Blue ink should be evaluated

388-28_(4,500Cps)+1Maths-1

SECTION – I

1. One mark to write the correct option and the corresponding answer.
2. If one of them (option or answer) is wrong, then award zero mark only.

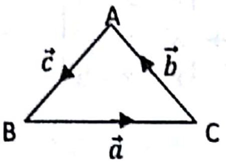
(CODE A)

Q.No	Option	Answer
1	(b)	$\{1,-1\}$
2	(a)	7
3	(a)	$P(A\cup B)=P(A)+P(B)$
4	(b)	$\frac{-\pi}{6}$
5	(c)	$\frac{2}{5}$
6	(a)	$\begin{cases} x, & x<1 \\ \sqrt{x}, & x\geq 1 \end{cases}$
7	(d)	160, 640
8	(a)	$(-\infty,0)$
9	(a)	$x-2\log(x+1)+c$
10	(a)	$24_{C_{12}}$
11	(c)	$\left(\frac{-\pi}{2},\frac{\pi}{2}\right)$
12	(d)	$\frac{1}{2}ab\sin C$
13	(d)	$x+2y=3$
14	(a)	20
15	(c)	$f(x)=cotx\ in \left(\frac{-\pi}{2},\frac{\pi}{2}\right]$
16	(c)	$\pm\frac{1}{\lvert\vec{a}\rvert}$
17	(a)	$(x+1)^2+(y+1)^2=1$
18	(b)	x
19	(a)	$-1<x\leq 1$
20	(d)	$tan^{-1}(e^x)+C$

(CODE – B)

Q.No	Option	Answer
1	(d)	$\frac{1}{2}ab\sin C$
2	(b)	$\{1,-1\}$
3	(d)	$x+2y=3$
4	(c)	$\left(\frac{-\pi}{2},\frac{\pi}{2}\right)$
5	(a)	$-1<x\leq 1$
6	(b)	x
7	(a)	$\begin{cases} x, & x<1 \\ \sqrt{x}, & x\geq 1 \end{cases}$
8	(a)	$(x+1)^2+(y+1)^2=1$
9	(c)	$f(x)=cotx\ in \left(\frac{-\pi}{2},\frac{\pi}{2}\right]$
10	(d)	$tan^{-1}(e^x)+C$
11	(a)	$P(A\cup B)=P(A)+P(B)$
12	(c)	$\pm\frac{1}{\lvert\vec{a}\rvert}$
13	(a)	$24_{C_{12}}$
14	(a)	$(-\infty,0)$
15	(d)	160, 640
16	(c)	$\frac{2}{5}$
17	(a)	$x-2\log(x+1)+c$
18	(a)	7
19	(a)	20
20	(b)	$\frac{-\pi}{6}$

SECTION – II

Q.NO	CONTENT	MARKS
21.	$-\begin{bmatrix} 1 & 0 & 2 \\ -1 & 5 & 3 \\ 2 & -1 & 1 \end{bmatrix}$ (or) $\begin{bmatrix} -1 & 0 & -2 \\ 1 & -5 & -3 \\ -2 & 1 & -1 \end{bmatrix}$	2
22.	Rough diagram 	1
	To prove $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ Note : The directions of $\vec{a}, \vec{b}, \vec{c}$ may differ	1
23.	Each of unit's and thousand's place can be filled in 1 way. Each of remaining two places can be filled in 5 ways.	1
	Therefore Total number of required numbers $= 1 \times 5 \times 5 \times 1$ $= 25$	1
24.	$t_7 = (-1)^{7+1}\left(\frac{7+1}{7}\right)$	1
	$t_7 = \frac{8}{7}$	1
25.	Let $P(x_1, 0)$ be the point on the *x*-axis. $(x_1-7)^2+36=(x_1-3)^2+16$	1
	Therefore required point $= \left(\frac{15}{2}, 0\right)$	1
26.	Point of intersection is $(-1,-1)$	1
	Required equation is $5x+3y+8=0$ or any other form	1
27.	$u = x, dv = e^{-x}dx$	1
	$\int xe^{-x}\,dx = -xe^{-x} - e^{-x} + C$	1
28.	$t = \sin^{-1}x$	1
	$\int \frac{e^{\sin^{-1}x}}{\sqrt{1-x^2}}dx = e^{\sin^{-1}x} + C$	1
29.	$P(A)+P(B)+P(C) \neq 1$	1
	It is not permissible.	1
30.	$f(x) = \sin\lvert x\rvert = \begin{cases} -\sin x, & x<0 \\ 0, & x=0 \\ \sin x, & x>0 \end{cases}$ or $\begin{cases} -\sin x, & x \le 0 \\ \sin x, & x>0 \end{cases}$ or $\begin{cases} -\sin x, & x<0 \\ \sin x, & x \ge 0 \end{cases}$	1
	$f'(x) = \begin{cases} -\cos x, & x<0 \\ \cos x, & x>0 \end{cases}$ $f'(x)$ does not exist at $x=0$.	1

SECTION – III

Note: In an answer to a question, between any two particular stages (2 marks) if a student starts from a stage with correct step but reaches the next stage with a wrong result then one mark should be given to the related steps instead of denying the 2 marks meant for the stage.

31.	$\begin{vmatrix} 2x+y & x & y \\ 2y+z & y & z \\ 2z+x & z & x \end{vmatrix} = \begin{vmatrix} 2x & x & y \\ 2y & y & z \\ 2z & z & x \end{vmatrix} + \begin{vmatrix} y & x & y \\ z & y & z \\ x & z & x \end{vmatrix}$	2
	= 0	1
	Note: This problem can be solved using alternative methods.	
32.	$\lvert\vec{a}\rvert = \sqrt{5}$	1
	$\hat{a} = \frac{1}{\sqrt{5}}(2\vec{i} - \vec{j})$	1
	Required vectors = $\pm\sqrt{5}(2\vec{i} - \vec{j})$	1
33.	Required number of signals	
	$= 6P_1 + 6P_2 + 6P_3 + 6P_4 + 6P_5 + 6P_6$	2
	= 1956	1
34.	To prove $abc + 2fgh - af^2 - bg^2 - ch^2 = 0$	2*
	$\theta = 90^0$	1
35.	$p^2 - q^2 == 4tan\theta sin\theta$	1
	$4\sqrt{pq} = 4\sqrt{tan^2\theta - sin^2\theta}$	1
	$\therefore p^2 - q^2 = 4\sqrt{pq}$	1
36.	$sec^2(x+y)\left(1+\frac{dy}{dx}\right) + sec^2(x-y)\left(1-\frac{dy}{dx}\right)=0$	2
	$\frac{dy}{dx} = -\frac{[sec^2(x+y)+sec^2(x-y)]}{sec^2(x+y)-sec^2(x-y)}$ (or) any other form	1
37.	$\int\sqrt{x^2-4x+6}\,dx = \int\sqrt{(x-2)^2+(\sqrt{2})^2}\,dx$	1
	$= \frac{(x-2)}{2}\sqrt{x^2-4x+6} + \frac{2}{2}\log\left(x-2+\sqrt{x^2-4x+6}\right) + C$ or any other form	2*

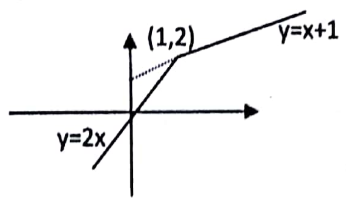
38.	$log_3x = log_3e \, log_ex$	2
	$\int log_3x \, dx = log_3e \; [x \, log_ex - x] + C$	1
	Note: Solution can be obtained by taking u=log_3x directly	
39.	Required Probability =	
	$P(A)\,P(B)\,P(\bar{C}) + P(A)\,P(\bar{B})\,P(C) + P(\bar{A})\,P(B)\,P(C)$	2
	$= \frac{13}{30}$	1
40.	$\lim_{x\to 0} f(x) = 4$	1
	$\lim_{x\to 0} f(x) \neq f(0)$	1
	$f(x)$ is not continuous at $x = 0$	1

SECTION – IV

Note: In an answer to a question, between any two particular stages of marks (2 or 3 marks) if a student starts from a stage with correct step but reaches the next stage with a wrong result then 1 or 2 marks should be given to the related steps instead of denying the entire marks meant for the stage.

41.a)	Let $\Delta = \begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix}$	
	a, b, c are factors of Δ	1
	$(a+b+c)^2$ is a factor of Δ	1
	Degree of Δ *is* 6	1
	Degree of the product of the factors is 5	
	$\therefore$ other factor = $k(a+b+c)$	
	k = 2	1
	$\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$	1
41.b)	Finding three vectors using four points	1
	Expressing one vector as a linear combination of other two vectors	1
	To find the values of the scalars	2
	The given vectors are lying on the same plane.	1

42.a)	$P(n): 7^{2n} + 16n - 1$ is divisible by 64	1
	$To\ prove\ P(1)$ is true.	1
	Assume $P(k)$ is true	1
	To prove $P(k+1)$	1
	$P(n)$ is true $\forall\, n \in N$	1
42.b)	$11^7 = (1+10)^7$	1
	$(1+10)^7 = 7_{C_0}1^7(10)^0 + 7_{C_1}1^6(10)^1 + \cdots + 7_{C_7}1^0(10)^7$	2*
	$11^7 = 19487171$	2
43.a)	$\sqrt[3]{x^3+6} - \sqrt[3]{x^3+3} = (x^3+6)^{1/3} - (x^3+3)^{1/3}$	1
	$= x\left(1+\frac{6}{x^3}\right)^{1/3} - x\left(1+\frac{3}{x^3}\right)^{1/3}$	1
	$= x\left(1+\frac{1}{3}\frac{6}{x^3}+\cdots\right) - x\left(1+\frac{1}{3}\frac{3}{x^3}+\cdots\right)$	1
	$= \frac{1}{x^2}$ (approximately)	2
43.b)	$2tan^2\theta + tan\theta - 1 = 0$	1
	$tan\theta = \frac{1}{2} \Rightarrow \theta = n\pi + tan^{-1}\frac{1}{2}, \quad n\epsilon Z$	1+1
	$tan\theta = -1 \Rightarrow \theta = n\pi - \frac{\pi}{4}, \quad n\epsilon Z$	1+1
44.a)	Statement : $tan\left(\frac{A-B}{2}\right) = \frac{a-b}{a+b}cot\frac{C}{2}$	1
	$\frac{a-b}{a+b}cot\frac{C}{2} = \frac{2RsinA - 2RsinB}{2RsinA + 2RsinB}cot\frac{C}{2}$	1
	$= \frac{2cos\left(\frac{A+B}{2}\right)sin\left(\frac{A-B}{2}\right)}{2sin\left(\frac{A+B}{2}\right)Cos\left(\frac{A-B}{2}\right)}cot\frac{C}{2}$	1
	$= cot\left(90-\frac{C}{2}\right)tan\left(\frac{A-B}{2}\right)cot\frac{C}{2}$	1
	$= tan\left(\frac{A-B}{2}\right)$	1
	Note : Any other Napier's formula can also be proved.	

44.b)	$g(f(x)) = (f(x)+1)^2 = 4x^2 - 12x + 9$	1
	$(f(x)+1)^2 = (2x-3)^2$	1
	$f(x)+1 = \pm(2x-3)$	1
	$f(x) = 2x-4$	1
	$f(x) = -2x+2$	1
45.a)	centre $C_1 = (1,-3)$, radius $r_1 = 2$	1
	centre $C_2 = \left(\frac{5}{2},-3\right)$, radius $r_2 = \frac{1}{2}$.	1
	$C_1C_2 = \frac{3}{2}$	1
	$r_1 - r_2 = \frac{3}{2}$	1
	Hence the Circles touch each other.	1
45.b)	$\lim_{x\to 0} \frac{\lvert x-1\rvert + \lvert x-2\rvert - 3}{2\lvert x-1\rvert - \lvert x-2\rvert}$	
	$= \lim_{x\to 0} \frac{(1-x)+(2-x)-3}{2(1-x)-(2-x)}$	2
	$= \lim_{x\to 0} \frac{-2x}{-x}$	2
	$= 2$	1
46.a)	Rough Diagram 	3
	$\therefore f(x)$ *is not differentiable at* $x = 1$	2

46.b)	$t = -\beta x^{\alpha},\ dt = -\alpha\beta x^{\alpha-1}dx$	2
	$\int \alpha\beta x^{\alpha-1}e^{-\beta x^{\alpha}}dx = \int e^{t}(-dt)$	1
	$= -e^{t} + C$	1
	$= -e^{-\beta x^{\alpha}} + C$	1
47.a)	$\Delta x = \frac{2}{n}$	1
	$f(a + r\Delta x) = 1 + \frac{4r^2}{n^2} + \frac{4r}{n}$	1
	$\int_1^3 x^2 dx = \lim_{n\to\infty} \frac{2}{n}\sum_{r=1}^{n}\left(1 + \frac{4r^2}{n^2} + \frac{4r}{n}\right)$	1
	$\int_1^3 x^2 dx = \frac{26}{3}$	2
47.b)	$P(A_1) = \frac{1}{2}, P(A_2) = \frac{1}{2}, P(B/A_1) = \frac{5}{11}, P(B/A_2) = \frac{4}{9}$	2
	$P(B) = P(A_1)\,P(B/A_1) + P(A_2)\,P(B/A_2)$	1
	$= \left(\frac{1}{2}\right)\left(\frac{5}{11}\right) + \left(\frac{1}{2}\right)\left(\frac{4}{9}\right)$	1
	$P(B) = \frac{89}{198}$	1