R

COMMON QUARTERLY EXAMINATION - 2023

Standard X

Reg.No.

MATHEMATICS

Time : 3.00 hrs *Marks : 100*

Part - I

I. Choose the correct answer: $14 \times 1 = 14$

1. If there are 1024 relations from a set A = {1,2,3,4,5} to a set B, then the number of elements in B is

   a) 3 b) 2 c) 4 d) 8

2. n(A) = P, n(B) = q, then n(A x B) = _____.

   a) p + q b) p − q c) p x q d) $\frac{p}{q}$

3. $7^{4K} \equiv$ _____ (mod 100)

   a) 1 b) 2 c) 3 d) 4

4. $\frac{3}{16}, \frac{1}{8}, \frac{1}{12}, \frac{1}{18}$ ..... The next term of the sequence is

   a) $\frac{1}{24}$ b) $\frac{1}{27}$ c) $\frac{2}{3}$ d) $\frac{1}{81}$

5. $y^2 + \frac{1}{y^2}$ is not equal to

   a) $\frac{y^4+1}{y^2}$ b) $\left(y+\frac{1}{y}\right)^2$ c) $\left(y-\frac{1}{y}\right)^2+2$ d) $\left(y+\frac{1}{y}\right)^2-2$

6. The square root of $\frac{256x^8y^4z^{10}}{25x^6y^6z^6}$ is equal to

   a) $\frac{16}{5}\left|\frac{x^2z^4}{y^2}\right|$ b) $16\left|\frac{y^2}{x^2z^4}\right|$ c) $\frac{16}{5}\left|\frac{y}{xz^2}\right|$ d) $\frac{16}{5}\left|\frac{xz^2}{y}\right|$

7. Graph of a linear polynomial is a

   a) straight line b) circle c) parabola d) hyperbola

8. In ΔLMN $\angle L = 60^\circ$, $\angle M = 50^\circ$, if $\Delta LMN \sim \Delta PQR$ then the value of $\angle R$ is

   a) 40° b) 70° c) 30° d) 110°

9. If in ΔABC, DE||BC, AB = 3.6 cm, AC = 2.4 cm and AD = 2.1 cm, then the length of AE is

   a) 1.4 cm b) 1.8 cm c) 1.2 cm d) 1.05 cm

10. The area of triangle formed by the points (−5,0), (0,−5), (5,0) is

    a) 0 sq.units b) 25 sq.u c) 5 sq.u d) none of these

11. If (5,7), (3,p) and (6,6) are collinear, then the value of p is

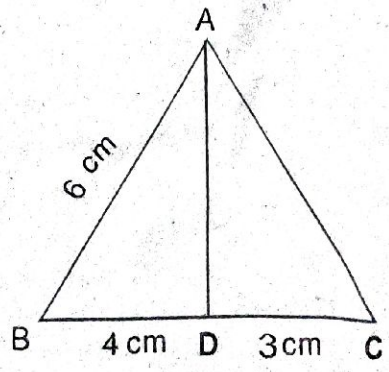
    a) 3 b) 6 c) 9 d) 12

12. A sequence is a function defined on the set of _____
    a) real numbers b) natural numbers
    c) whole numbers d) integers
13. Value of $\tan\theta \operatorname{cosec}^2\theta - \tan\theta$
    a) $\sec\theta$ b) $\cot^2\theta$ c) $\sin\theta$ d) $\cot\theta$
14. $5x = \sec\theta$, $\frac{5}{x} = \tan\theta$. If $x^2 - \frac{1}{x^2}$ is equal to
    a) 25 b) $\frac{1}{25}$ c) 5 d) 1

Part - II

II. **Answer any 10 questions. (Q.No.28 is compulsory)** **10 x 2 = 20**

15. $B \times A = \{(-2,3), (-2,4), (0,3), (0,4), (3,3), (3,4)\}$, find A and B
16. Find fog and gof when $f(x) = 2x + 1$ and $g(x) = x^2 - 2$
17. Find the number of terms in the A.P 3,6,9,12 111
18. Find the sum of $2 + 4 + 6 + \ldots\ldots + 80$
19. Find the LCM of $5x - 10$, $5x^2 - 20$
20. Find the excluded value of the following expression $\frac{t}{t^2 - 5t + 6}$
21. Determine the nature of the roots of the quadratic equation $9x^2 - 24x + 16 = 0$
22. AD is the bisector of $\angle A$. If BD = 4 cm, DC = 3 cm and AB = 6 cm, find AC



23. If ΔABC is similar to ΔDEF such that BC = 3 cm, EF = 4 cm and area of ΔABC = 54 cm^2. Fnd the area of ΔDEF.
24. Show that the points P(–1.5,3), Q(6,–2), R(–3,4) are collinear.
25. Find the slope of the line joining the points $(5, \sqrt{5})$ with the origin.

26. Prove that $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \operatorname{cosec}\theta + \cot\theta$

27. Solve $2x^2 - 3x - 3 = 0$ by formula method.

28. Find the equation of the line passing through the point (3,–4) and having slope $\frac{-5}{7}$

Part - III

III. Answer any 10 questions. (Q.No.42 is compulsory) **10 x 5 = 50**

29. Let A = {3,4,7,8}, B = {1,7,10} which of the following sets are relations from A to B?
    i) R_1 = {(3,7), (4,7), (7,10), (8,1)}
    ii) R_2 = {(3,1), (4,12)}
    iii) R_3 = {(3,7), (4,10), (7,7), (7,8), (8,11), (8,7), (8,10)}

30. If the function f is defined by $f(x)\begin{cases} x+2 & ; \quad x > 1 \\ 2 & ; \quad -1 \le x \le 1 \\ x-1 & ; \quad -3 < x < -1 \end{cases}$, find the values of
    i) f(3) ii) f(0) iii) f(–1.5) iv) f(2) + f(–2)

31. The ratio of 6th and 8th term of an A.P is 7 : 9. Find the ratio of 9th and 13th term.

32. Find the sum to n terms of the series
    5 + 55 + 555 + ...

33. If $1^3 + 2^3 + 3^3 + \ldots\ldots + k^3 = 44100$, then find $1 + 2 + 3 + \ldots\ldots + k$

34. Find the GCD of the polynomial $x^3 + x^2 - x + 2$ and $2x^3 - 5x^2 + 5x - 3$

35. State and prove Basic proportionality theorem.

36. Find the square root of $x^4 - 12x^3 + 42x^2 - 36x + 9$

37. Find the area of the quadrilateral whose vertices are (–9,–2), (–8,–4), (2,2) and (1,–3)

38. Without using Pythagoras theorem, show that the points (1,–4), (2,–3), (4,–7) form a right angled triangle.

39. If $\sin\theta + \cos\theta = p$ and $\sec\theta + \operatorname{cosec}\theta = q$, then prove that $q(p^2 - 1) = 2p$

40. Let f:A→B be a function defined by $f(x) = \frac{x}{2} - 1$ where A = {2,4,6,10,12}, b = {0,1,2,4,5,9} represent f by
    i) set of ordered pairs
    ii) table
    iii) an arrow diagram
    iv) a graph

41. Find the sum of all natural numbers between 300 and 600 which are divisible by 7.

42 Solve : $\sqrt{y+1} + \sqrt{2y-5} = 3$

Part - IV

IV. Answer all the questions. $2 \times 8 = 16$

43. a) Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{2}{3}$ of the corresponding sides of the triangle PQR. (Scale factor $\frac{2}{3}$)

(OR)

b) Construct a triangle PQR such that QR = 5 cm, $\angle P = 30^\circ$ and the altitude from P to QR is of length 4.2 cm.

44. a) Draw the graph of $xy = 24$, $x, y > 0$ using the graph

i) If $x = 3$, find y

ii) If $y = 6$, find x.

(OR)

b) A Two wheeler parking zone near bus stand charges as below.

Time in hrs. (x)	4	8	12	24
Amount ₹ (y)	60	120	180	360

Check If the amount charged are in direct or inverse variation to the parking time.

i) Find the amount to be paid when parking time is 6 hrs.

ii) Find the parking duration when the amount paid is ₹150

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QUARTERLY EXAM – 2023

10TH – MATHS ANSWER KEY

RANIPET DIST.

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I. CHOOSE THE CORRECT ANSWER:

1	(b)	2
2	(c)	PXQ
3	(a)	1
4	(b)	$\frac{1}{27}$
5	(b)	$\left(y+\frac{1}{y}\right)^2$
6	(d)	$\frac{16}{5}\left\|\frac{xz^2}{y}\right\|$
7	(a)	Straight line
8	(b)	70°
9	(a)	1.4 cm
10	(b)	25 Sq. Units
11	(c)	9
12	(b)	natural numbers
13	(d)	Cot θ
14	(b)	$\frac{1}{25}$

II. ANSWER ANY 10 QUESTIONS:

(15)

$A = \{3, 4\}$

$B = \{-2, 0, 3\}$

(16)

$fog = 2(x^2-2)+1 = 2x^2-3$

$gof = (2x+1)^2-2 = 4x^2+4x-1$

(17)

$a = 3 \quad d = 6-3 = 3 \quad l = 111$

$n = \left(\frac{l-a}{d}\right)+1$

$= \left(\frac{111-3}{3}\right)+1$

$n = 37$

(18)

$2(1+2+3+\cdots\cdots+40)$

$2\left[\frac{n(n+1)}{2}\right]$

$2 \times \left[\frac{40 \times 41}{2}\right] = 1640$

(19)

$5x-10 = 5(x-2)$

$5x^2-20 = 5(x+2)(x-2)$

$\therefore$ LCM $= 5(x+2)(x-2)$

(20)

$t^2-5t+6 = 0$

$(t-3)(t-2) = 0$

$t = 3 \quad t = 2$

(21)

$a = 9$
$b = -24$
$c = 16$

$\Delta = b^2-4ac$

$\Delta = (-24)^2-4(9)(16)$

$\Delta = 0$

$\therefore$ The roots are real and equal

(22)

By Angle Bisector theorem,

$\frac{AB}{AC} = \frac{BD}{DC}$

$\frac{6}{AC} = \frac{4}{3}$

$AC = \frac{9}{2} = 4.5$ cm

(23)

$\frac{\text{Area}(\Delta ABC)}{\text{Area}(\Delta DEF)} = \frac{BC^2}{EF^2}$

$\frac{54}{\text{Area}(\Delta DEF)} = \frac{3^2}{4^2}$

$\text{Area}(\Delta DEF) = \frac{16 \times 54}{9} = 96 \text{ cm}^2$

(24)

Area of $\Delta PQR = \frac{1}{2}\begin{vmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{vmatrix}$

$= \frac{1}{2}[(3+24-9)-(18+6-6)]$

$= 0$

$\therefore$ The given points are Collinear

(25) Slope $m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{0-\sqrt{5}}{0-5} = \frac{\sqrt{5}}{5} = \frac{1}{\sqrt{5}}$

(26) $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \sqrt{\frac{(1+\cos\theta)}{(1-\cos\theta)} \times \frac{(1+\cos\theta)}{(1+\cos\theta)}}$

$= \sqrt{\frac{(1+\cos\theta)^2}{1-\cos^2\theta}} = \frac{1+\cos\theta}{\sin\theta}$

$= \operatorname{Cosec}\theta + \operatorname{Cot}\theta$

(27) $a=2 \quad b=-3 \quad c=-3$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-(-3) \pm \sqrt{(-3)^2-4(2)(-3)}}{2(2)}$

$x = \frac{3 \pm \sqrt{33}}{4}$

$\therefore x = \frac{3+\sqrt{33}}{4}, \quad \frac{3-\sqrt{33}}{4}$

(28) $y - y_1 = m(x - x_1)$

$y + 4 = -\frac{5}{7}(x - 3)$

$5x + 7y + 13 = 0$

III ANSWER ANY 10 QUESTIONS:

(29) $A \times B = \{(3,1), (3,7), (3,10), (4,1), (4,7), (4,10), (7,1), (7,7), (7,10), (8,1), (8,7), (8,10)\}$

(i) $R_1 \subseteq A \times B$.

$\Rightarrow R_1$ is a relation from A to B.

(ii) $(4,12) \in R_2$ but $(4,12) \notin A \times B$.

$\Rightarrow R_2$ is not a relation from A to B.

(iii) $(7,8) \in R_3$ but $(7,8) \notin A \times B$. (8,11) (8,11)

$\Rightarrow R_3$ is not a relation from A to B.

(30) (i) $f(3)$

$f(x) = x + 2$

$f(3) = 5$

(ii) $f(0)$

$f(x) = 2$

$f(0) = 2$

(iii) $f(-1.5)$

$f(x) = x - 1$

$f(-1.5) = -2.5$

(iv) $f(2) + f(-2) = 4 + (-3) = 1$

$(f(x) = x+2 \quad f(x) = x-1$

$f(2) = 4 \quad f(-2) = -3)$

(31) $t_6 : t_8 = 7:9 \Rightarrow \frac{t_6}{t_8} = \frac{7}{9}$

$\frac{a+5d}{a+7d} = \frac{7}{9}$ $\boxed{a = 2d}$

$t_9 : t_{13} = \frac{t_9}{t_{13}} = \frac{a+8d}{a+12d} = \frac{5}{7} = 5:7$

(32) $5 + 55 + 555 + \cdots + n \text{ terms}$

$5(1 + 11 + 111 + \cdots + n \text{ terms})$

$\frac{5}{9}[9 + 99 + 999 + \cdots + n \text{ terms}]$

$\frac{5}{9}[(10-1) + (100-1) + (1000-1) + \cdots + n \text{ terms}]$

$\frac{5}{9}[(10 + 100 + 1000 + \cdots + n \text{ terms}) - n]$

$\frac{5}{9}\left[\frac{10(10^n-1)}{(10-1)} - n\right] = \frac{50(10^n-1)}{81} - \frac{5n}{9}$

(33) $\left[\frac{K(K+1)}{2}\right]^2 = 44100 = (210)^2$

$\frac{K(K+1)}{2} = 210$

$1 + 2 + 3 + \cdots + K = 210$

(34)

$x^3 + x^2 - x + 2$) $2x^3 - 5x^2 + 5x - 3$ (2

$2x^3 \ominus 2x^2 \oplus 2x \ominus 4$

$-7x^2 + 7x - 7$

$= -7(x^2 - x + 1)$

$x^2 - x + 1$) $x^3 + x^2 - x + 2$ ($x + 2$

$x^3 \ominus x^2 \oplus x$

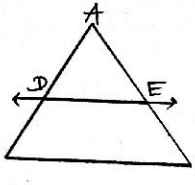
$2x^2 - 2x + 2$

$2x^2 \ominus 2x \oplus 2$

0

$\therefore GCD = x^2 - x + 1$

(35) Basic proportionality theorem (Thales theorem)



$$\frac{AD}{DB} = \frac{AE}{EC}$$

(36)

		1	−6	+3
	1	1	−12	+42	−36	+9
			1	−12	+42	−36
2	−6			−12	+36	−72
					6	−36	+72
2	−12	+36			6	−36	+72
						0

$$= |x^2 - 6x + 3|$$

(37) A(2,2) B(9,−2) C(−8,−4) D(1,−3)

$$\text{Area of } ABCD = \frac{1}{2}\begin{bmatrix} 2 & -9 & -8 & 1 & 2 \\ 2 & -2 & -4 & -3 & 2 \end{bmatrix}$$

$$= \frac{1}{2}\left[(-4+36+24+2) - (-18+16-4-6)\right]$$

$$= \frac{1}{2}(58+12) = \frac{1}{2}(70) = 35 \text{ Sq. units}$$

(38) Let A(1,−4) B(2,−3) C(4,−7)

$$\text{Slope of } AB = \frac{-3+4}{2-1} = 1$$

$$\text{Slope of } BC = \frac{-7+3}{4-2} = -2$$

$$\text{Slope of } AC = \frac{-7+4}{4-1} = -1$$

Slope of AB × Slope of AC = (1)(−1) = −1

∴ AB ⊥ AC ⇒ ∠A = 90°

∴ ΔABC is a right angle.

(39)

$$9(p^2-1) = (\sec\theta + \operatorname{cosec}\theta)((\sin\theta + \cos\theta)^2 - 1)$$

$$= (\sec\theta + \operatorname{cosec}\theta)(\sin^2\theta + \cos^2\theta + 2\sin\theta\cdot\cos\theta - 1)$$

$$= (\sec\theta + \operatorname{cosec}\theta)(1 + 2\sin\theta\cdot\cos\theta - 1)$$

$$= \left(\frac{1}{\cos\theta} + \frac{1}{\sin\theta}\right)(2\sin\theta\cdot\cos\theta)$$

$$= \frac{\sin\theta + \cos\theta}{\sin\theta\cos\theta} \times 2\sin\theta\cdot\cos\theta$$

$$= 2(\sin\theta + \cos\theta)$$

$$= 2p$$

(40) f(2) = 0 f(6) = 2 f(12) = 5

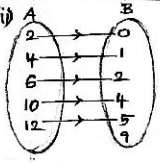
f(8) = 1 f(10) = 4

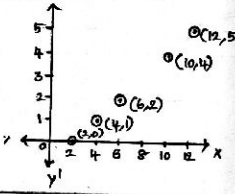
(i) $f = \{(2,0), (4,1), (6,2), (10,4), (12,5)\}$

(ii)

x	2	4	6	10	12
f(x)	0	1	2	4	5

(iii)





(41) $301 + 308 + 315 + \cdots + 595$

$a = 301 \quad d = 7 \quad l = 595$

$$n = \left(\frac{l-a}{d}\right) + 1$$

$$n = \left(\frac{595-301}{7}\right) + 1$$

$$n = 43$$

$$S_n = \frac{n}{2}[a+l]$$

$$S_{43} = \frac{43}{2}[301+595]$$

$$= 19264$$

(42) $\sqrt{y+1} + \sqrt{2y-5} = 3$

$$\sqrt{2y-5} = 3 - \sqrt{y+1}$$

Taking Square on both sides,

$$2y-5 = (3-\sqrt{y+1})^2$$

$$2y-5 = 9 + y + 1 - 6\sqrt{y+1}$$

$$y - 15 = -6\sqrt{y+1}$$

Taking Square on both sides,

$$(y-15)^2 = (-6\sqrt{y+1})^2$$

$$y^2 - 30y + 225 = 36(y+1)$$

$$y^2 - 66y + 189 = 0$$

$$(y-3)(y-63) = 0$$

$y = 3 \quad y = 63$

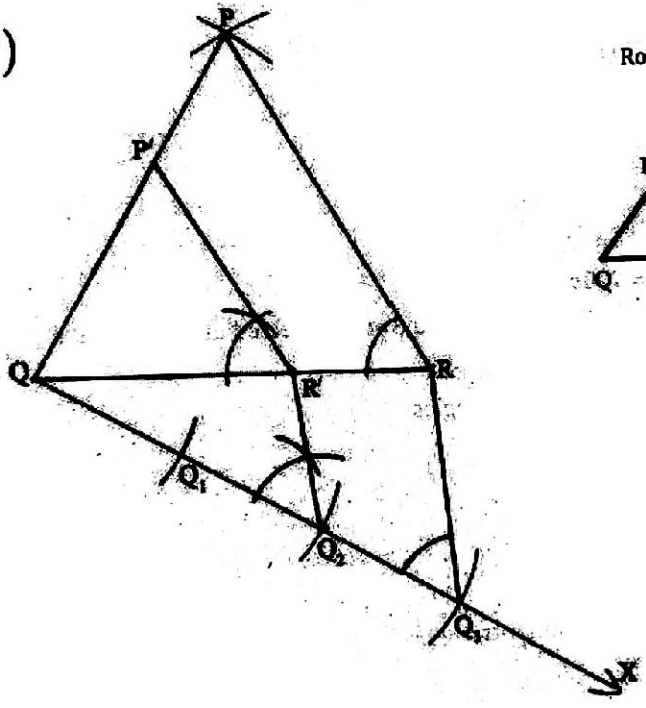
+189
−63 −3
−66

$y = 63$ does not satisfy the eqn.

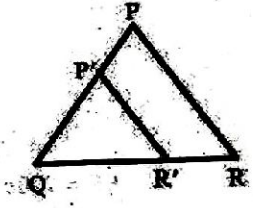
∴ $y = 63$ is not a Sol.

∴ only Sol. is $y = 3$

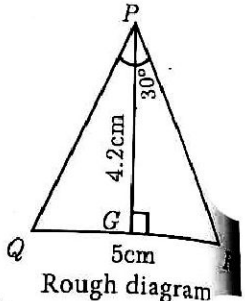
43(a)



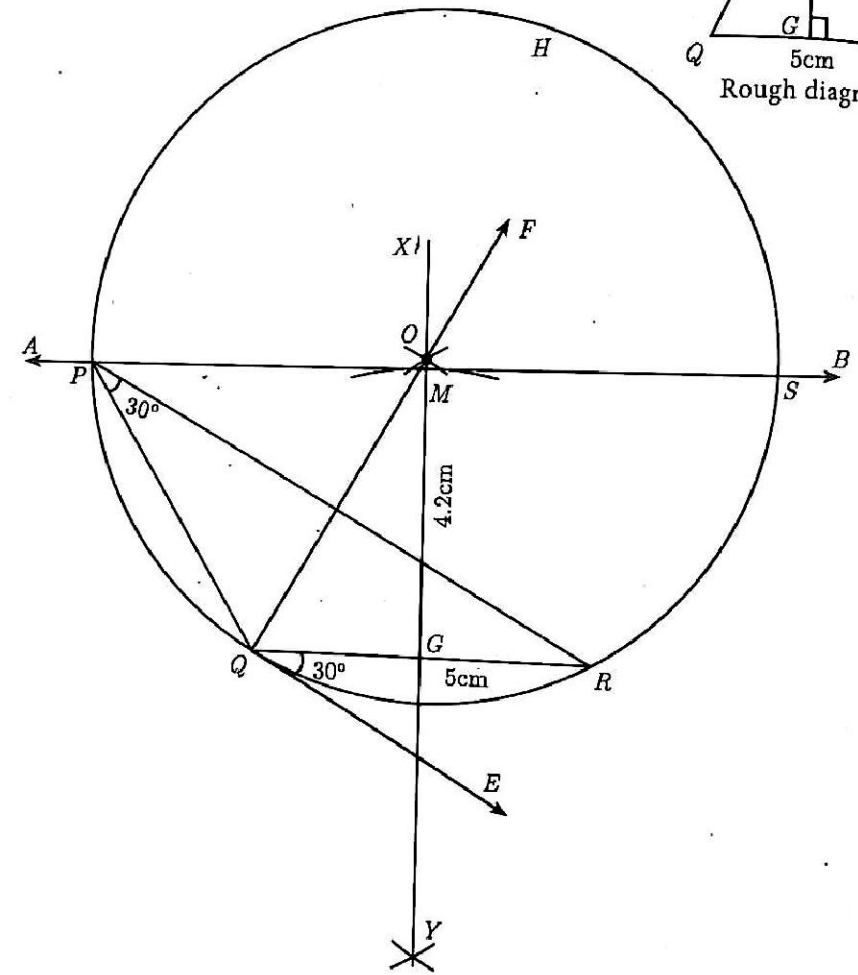
Rough Diagram



43 (b)



Rough diagram



44(a)

1. Table :

x	24	12	8	6	4	3	2	1
y	1	2	3	4	6	8	12	24

2. Variation : Indirect Variation

3. Equation : $xy = K$

$xy = 24 \times 1 = 12 \times 2 = \ldots\ldots = 12$

$xy = 24$

4. Points :

(24, 1), (12, 2), (8, 3), (6, 4), (4, 6), (3, 8), (2, 12), (1, 24)

5. Solution :

(i) If $x = 3$ then $y = 8$

(ii) If $y = 6$ then $x = 4$

44(b)

1. Table :

Time in hrs (x)	4	8	12	24
Amount ₹ (y)	60	120	180	360

2. Variation : Direct Variation

3. Equation : $y = Kx$

$K = \frac{y}{x} = \frac{60}{4} = \frac{120}{8} = \ldots\ldots = 15$

$y = 15x$

4. Points : (4, 60), (8, 120), (12, 180), (24, 360)

5. Solution :

(i) If the parking time is 6 hours, then the parking charge = ₹90

(ii) If the amount ₹150 is paid, then the parking time = 10 hours.