10 CLASS

MATHEMATICS (STANDARD & BASIC)

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FOR CBSE EXAMS

Session 2025-26

SOLUTIONS

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O.P. GUPTA

INDIRA AWARD WINNER

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MATHMISSION Series

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Mathematics (Standard & Basic)
Topic - Real Numbers

RTS-01

CLICK HERE FOR ANSWERS

RANKERS TEST SERIES FOR X

Max. Marks - 40
Time - 90 Minutes

SECTION A

*Following multiple choice questions are of **1 Mark** each (Q01-10).*
Select the correct option in each one of them.

Q01. The LCM of a smallest 2-digit number and smallest composite number is
(A) 12 (B) 4 (C) 20 (D) 40

Q02. The total number of factors of a prime number is
(A) 1 (B) 0 (C) 2 (D) 3

Q03. If HCF $(2520, 6600) = 120$, LCM $(2520, 6600) = 252 \times k$, then value of k is
(A) 1650 (B) 550 (C) 16632000 (D) 155

Q04. The LCM of the smallest prime number and the smallest odd composite number is
(A) 10 (B) 6 (C) 9 (D) 18

Q05. The sum of exponents of prime factors in the prime-factorization of 196 is
(A) 3 (B) 4 (C) 5 (D) 6

Q06. The LCM of two prime numbers p and q, $p > q$ is 221. Then the value of $(3p - q) =$
(A) 4 (B) 28 (C) 38 (D) 48

Q07. If two positive integers p and q are written as $p = x^2y^2$, $q = xy^3$; where x and y are prime numbers, then HCF (p, q) is
(A) xy (B) xy^2 (C) x^3y^3 (D) x^2y^2

Q08. The ratio between the LCM and HCF of $5, 15, 20$ is
(A) $9:1$ (B) $4:3$ (C) $11:1$ (D) $12:1$

*Followings are **Assertion-Reason based questions** (Q09 & 10).*
In the following questions, a statement of Assertion (**A**) is followed by a statement of Reason (**R**). Choose the correct answer out of the following choices.
(A) Both **A** and **R** are true and **R** is the correct explanation of **A**.
(B) Both **A** and **R** are true and **R** is not the correct explanation of **A**.
(C) **A** is true but **R** is false.
(D) **A** is false but **R** is true.

Q09. **Assertion (A) :** $-\sqrt{5}$ is irrational number.
Reason (R) : If m is an odd number greater than 1, then $\sqrt{m}$ is irrational.

Q10. **Assertion (A) :** Let 'a' and 'b' be two positive integers such that $a = p^3q^4$ and $b = p^2q^2$ where 'p' and 'q' are prime numbers. If $\text{HCF}(a, b) = p^mq^n$ and $\text{LCM}(a, b) = p^rq^s$, then $(m+n):(r+s) = 4:7$.
Reason (R) : The sum or difference of a rational and an irrational number is an irrational number.

$[1 \times 10 = 10$

SECTION B

*Followings are of **2 Marks** each (Q11-12).*

Q11. Prove that $2 + 5\sqrt{3}$ is irrational, given that $\sqrt{3}$ is an irrational number.

Q12. (a) If the HCF of 1032 and 408 is expressible in the form $1032p - 408 \times 5$, then find the value of $p - 2$.

OR

(b) Why $11 \times 13 \times 17 \times 19 - 17$ is a composite number? Explain.

$[2 \times 2 = 4$

SECTION C

*Followings are of **3 Marks** each (Q13-16).*

Q13. Prove that $\sqrt{7}$ is irrational number.

Q14. Three bells ring at intervals of 6, 12 and 18 minutes. If all the three bells ring at 6 a.m., when will they ring together again?

Q15. (a) Find the smallest number, which when divided by 39, 52 and 91 leaves a remainder of 13 in each case.

OR

(b) What is the least multiple of 7 which when divided by 4, 12 and 16 leaves remainder 3 in each case?

Q16. Prove that $\sqrt{2}+\sqrt{5}$ is irrational.

$[3\times4=12$

SECTION D

*Followings are of **5 Marks** each (Q17-18).*

Q17. Find the greatest number that will divide 382, 509 and 636 leaving remainders 4, 5 and 6 respectively.

Q18. (a) Find LCM and HCF of 78, 91 and 195. Check whether LCM $(a,b,c)\times$ HCF $(a,b,c)=a\times b\times c$.

OR

(b) If $\sqrt{ab}$ is an irrational number, prove that $(\sqrt{a}+\sqrt{b})$ is irrational number.

$[5\times2=10$

SECTION E

*Following is a case-study based question of **4 Marks** (Q19); having three sub-parts (i), (ii) and (iii).*

Q19. Teaching Mathematics through activities is an effective way to deepen the understanding of students and increase their interest in the subject. Keeping this in mind, Ms. Mukta planned a **prime number game** for her students.

She started the game by announcing the number 2 and asked the first student to multiply it by any prime number before passing the result to the second student. Second student also multiplied it by a prime number and passed it to third student.

That is, each subsequent student followed the same rule : multiplying the received number by a prime number and passing it on. This process continued until the final student obtained the number 173250.

Based on the above information, answer the questions given below.

(i) What is the least prime number used by students?

(ii) Which prime number has been used maximum times?

(iii) (a) How many students are in the class?

OR

(b) What is the highest prime number used by students?

$[1+1+2=4$

ANSWERS : RTS-01

Q01. (C) Smallest 2-digit number is 10 and smallest composite number is 4.
Note that, $10 = 2 \times 5$, $4 = 2^2$.
So, $\text{LCM}(10, 4) = 2^2 \times 5 = 20$.

Q02. (C) A number is called prime if it has only **two** distinct factors : 1 and the number itself.
That means a prime number always has **two** factors.

Q03. (B) Using $\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$, we get $120 \times 252 \times k = 2520 \times 6600$
$\Rightarrow 12 \times k = 10 \times 660$
$\Rightarrow k = \frac{6600}{12} = \frac{1100}{2}$
$\therefore k = 550$.

Q04. (D) The smallest prime number is 2 and the smallest odd composite number is 9 (i.e., 3^2).
$\therefore \text{LCM}(2, 9) = 2 \times 3^2 = 18$.

Q05. (B) $\because 196 = 2^2 \times 7^2$; clearly the sum of exponents of prime factors is $2 + 2 = 4$.

Q06. (C) $\because 221 = 13 \times 17$; it is given that $p > q$. So, $p = 17$, $q = 13$.
Hence, $(3p - q) = 3 \times 17 - 13 = 51 - 13 = 38$.

Q07. (B) $\text{HCF}(p, q) = \text{HCF}(x^2y^2, xy^3) = xy^2$.

Q08. (D) $\because 5 = 5^1$, $15 = 3 \times 5$, $20 = 2^2 \times 5$.
Note that, $\text{HCF}(5, 15, 20) = 5$; $\text{LCM}(5, 15, 20) = 5 \times 3 \times 2^2 = 60$.
Therefore, the ratio between the LCM and HCF of 5, 15, 20 is $60 : 5 = 12 : 1$.

Q09. (C) Assertion is true, however Reason is false.
Note that, if we take $m = 9$, then $\sqrt{m} = \sqrt{9} = 3$ (which is not irrational).

Q10. (B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Q11. Let us assume that $2 + 5\sqrt{3}$ is rational.
Then there exists two coprime integers a and b where $b \neq 0$ such that

$$2 + 5\sqrt{3} = \frac{a}{b}$$

So, $$\sqrt{3} = \frac{a}{5b} - \frac{2}{5}$$

$$\Rightarrow \sqrt{3} = \frac{a - 2b}{5b}$$

Since a and b are integers, so $\frac{a - 2b}{5b}$ is rational, and so $\sqrt{3}$ is rational as well.
But this contradicts the fact that $\sqrt{3}$ is irrational.
This contradiction has arisen because of our incorrect assumption that $2 + 5\sqrt{3}$ is rational.
Hence, $2 + 5\sqrt{3}$ is irrational.

Q12. (a) $\because 1032 = 2^3 \times 3 \times 43$; $408 = 2^3 \times 3 \times 17$.
So, $\text{HCF} = 2^3 \times 3 = 24$.
Now $1032p - 408 \times 5 = 24$
$\Rightarrow 1032p - 2040 = 24$
$\Rightarrow 1032p = 2064$
$\Rightarrow p = 2$
Hence, $(p - 2) = 2 - 2 = 0$.

OR

SECTION A

*Following multiple choice questions are of **1 Mark** each (Q01-10).*
Select the correct option in each one of them.

Q01. It is given that α and β are the zeroes of the quadratic polynomial $p(x)=x^2-p(x+1)-c$, such that $(\alpha+1)(\beta+1)=0$, then the value of c is

(A) 0 (B) 1 (C) -1 (D) 2

Q02. What should be added to the polynomial $f(x)=x^2-5x+4$, so that 3 becomes a zero of the resulting polynomial?

(A) 1 (B) -2 (C) 4 (D) 2

Q03. The graph of a polynomial $p(x)$ passes through the points $(-5, 0)$, $(0, -40)$, $(8, 0)$ and $(5, -30)$, then which of the following is a factor of $p(x)$?

(A) $x^2-3x-40$ (B) $x^2-13x-40$ (C) x^2-25 (D) None of these

Q04. The number of real zeroes of the polynomial $293x^3-293$ is

(A) 0 (B) 1 (C) 2 (D) 3

Q05. If α and β are the zeroes of the polynomial $p(s)=s^2-as-b$, then the value of $(\alpha^2+\beta^2)$ is

(A) b^2-2a (B) b^2+2a (C) a^2+ab (D) a^2+2b

Q06. If one zero of the quadratic polynomial ax^2+bx+c is double the other, then which of the following is true?

(A) $2b^2=9ac$ (B) $3b^2=2bc$ (C) $b^2=4ac$ (D) $2c^2=9ab$

Q07. The quadratic polynomial whose zeroes are $\frac{3+\sqrt{5}}{5}$ and $\frac{3-\sqrt{5}}{5}$, is

(A) $25x^2-30x+4$ (B) $5x^2-6x+4$ (C) $25x^2-30x+20$ (D) $\frac{1}{5}(5x^2+6x+4)$

Q08. If 2 and $\frac{1}{2}$ are the zeroes of px^2+5x+r, then

(A) $p=r=2$ (B) $p=r=-2$ (C) $p=2, r=-2$ (D) $p=-2, r=2$

*Followings are **Assertion-Reason based questions** (Q09 & 10).*

In the following questions, a statement of Assertion (**A**) is followed by a statement of Reason (**R**). Choose the correct answer out of the following choices.

(A) Both **A** and **R** are true and **R** is the correct explanation of **A**.
(B) Both **A** and **R** are true and **R** is not the correct explanation of **A**.
(C) **A** is true but **R** is false.
(D) **A** is false but **R** is true.

Q09. **Assertion (A) :** If a quadratic polynomial has equal zeroes, then its graph touches the x-axis at exactly one point.

Reason (R) : A quadratic polynomial represented by ax^2+bx+c, $a \neq 0$ has equal zeroes, if and only if its discriminant (b^2-4ac) is a non-negative and non-zero real number.

Q10. **Assertion (A) :** The graph of the quadratic polynomial ax^2+bx+c opens upwards, if $a>0$.

Reason (R) : The sign of the coefficient 'a' in the quadratic polynomial determines the direction in which the parabola opens.

[$1\times10=10$

SECTION B

*Followings are of **2 Marks** each (Q11-12).*

Q11. Find the zeroes of the polynomial $t^2-3t-m(m+3)$.

Q12. (a) If $(x-\alpha)$ is a factor of two quadratic polynomials x^2+px+q and x^2+mx+n, then prove that $\alpha=\dfrac{n-q}{p-m}$.

OR

(b) If sum of the zeroes of $5x^2+(p+q+r)x+pqr$ is zero (0), then find the value of $p^3+q^3+r^3$.

[$2\times 2=4$

SECTION C

*Followings are of **3 Marks** each (Q13-16).*

Q13. If α and β are the zeroes of the polynomial $f(t)=t^2-3t-2$, then find a quadratic polynomial whose zeroes are $\left(\dfrac{1}{2\alpha+\beta}\right)$ and $\left(\dfrac{1}{2\beta+\alpha}\right)$.

Q14. If α and β are the zeroes of $f(y)=2y^2+5y+k$ and they satisfy the relation $\alpha^2+\beta^2+\alpha\beta=\dfrac{21}{4}$, then find the value of k.

Q15. (a) If the squared difference of the zeroes of $g(t)=t^2+pt+45$ is 144, then find the value (s) of p.

OR

(b) If α and β are the zeroes of polynomial $25x^2-15x+12$, then find a quadratic polynomial whose zeroes are $\dfrac{1}{2\alpha}$ and $\dfrac{1}{2\beta}$.

Q16. If α and β are the zeroes of the polynomial x^2-6x+a, find the value of a, if $3\alpha+2\beta=20$.

[$3\times 4=12$

SECTION D

*Followings are of **5 Marks** each (Q17-18).*

Q17. If α and β are the zeroes of the polynomial $f(x)=x^2-px+q$, prove that $\dfrac{\alpha^2}{\beta^2}+\dfrac{\beta^2}{\alpha^2}=\dfrac{p^4}{q^2}-\dfrac{4p^2}{q}+2$.

Q18. (a) If α and β are the zeroes of the quadratic polynomial $f(x)=ax^2+bx+c$, then find the value of $a\left(\dfrac{\alpha^2}{\beta}+\dfrac{\beta^2}{\alpha}\right)+b\left(\dfrac{\alpha}{\beta}+\dfrac{\beta}{\alpha}\right)$.

OR

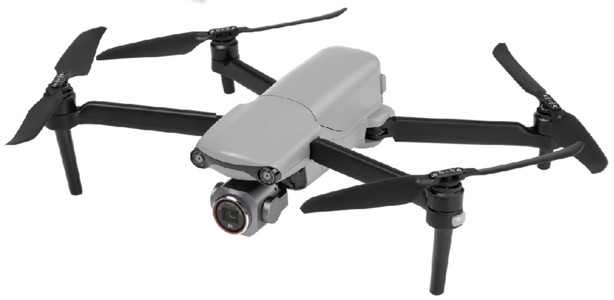
(b) If α and β are the zeroes of quadratic polynomial $p(x)=6x^2+x-1$, then determine the value of $\dfrac{\alpha}{\beta}+\dfrac{\beta}{\alpha}+2\left(\dfrac{1}{\alpha}+\dfrac{1}{\beta}\right)+3\alpha\beta$.

[$5\times 2=10$

SECTION E

*Following is a case-study based question of **4 Marks** (Q19); having three sub-parts (i), (ii) and (iii).*

Q19. A drone is sent on a surveillance mission along a straight road.



The diagram shown is for the representation purpose only.

The drone's height $h(t)$ in metres at time t seconds is given by the polynomial

$$h(t)=-5t^2+40t+100,$$

which represents the drone's height from the moment it starts vertically up from the base station at $t=0$, till it comes back down.

Based on the above information, answer the questions given below.

(i) Find the initial height of the drone.

(ii) At what time will the drone reach its maximum height?

(iii) (a) Factorize the polynomial $h(t) = -5t^2 + 40t + 100$ and hence find the time when the drone is at ground level.

OR

(b) Find the zeroes of the polynomial $h(t) = -5t^2 + 40t + 100$ and verify the relationship between the zeroes obtained and coefficients of the polynomial $h(t)$.

[1 + 1 + 2 = 4

ANSWERS : RTS-02

Q01. (B) For $p(x)=x^2-p(x+1)-c=x^2-px-(p+c)$, $\alpha+\beta=-\left(\frac{-p}{1}\right)=p$, $\alpha\beta=\frac{-(p+c)}{1}=-(p+c)$.

Also $(\alpha+1)(\beta+1)=0$

$\Rightarrow \alpha\beta+\alpha+\beta+1=0$

$\Rightarrow -p-c+p+1=0$

$\therefore c=1$.

Q02. (D) Let the number to be added k.

We need 3 to be a zero of the **new** polynomial.

That is, $f(3)+k=0$

$\Rightarrow 3^2-5\times3+4+k=0$

$\Rightarrow 9-15+4+k=0$

$\Rightarrow -2+k=0$

$\therefore k=2$.

Q03. (A) The polynomial passes through the points (−5, 0) and (8, 0).

This means, $p(-5)=0$ and $p(8)=0$.

So, $(x+5)$ and $(x-8)$ are factors of the polynomial $p(x)$.

Then the product $(x+5)(x-8)=x^2-3x-40$, which matches with option (A).

Q04. (B) For the zeroes of the given polynomial, we take $293x^3-293=0$

$\Rightarrow 293(x^3-1)=0$

$\Rightarrow (x-1)(x^2+x+1)=0$

$\therefore x=1$ is the real zero of polynomial.

Therefore, the number of real zeroes of the polynomial $293x^3-293$ is 1 (one).

Q05. (D) For $p(s)=s^2-as-b$, $\alpha+\beta=-\left(\frac{-a}{1}\right)=a$ and $\alpha\beta=\left(\frac{-b}{1}\right)=-b$.

$\therefore (\alpha^2+\beta^2)=(\alpha+\beta)^2-2\alpha\beta=(a)^2-2(-b)=a^2+2b$.

Q06. (A) Let the zeroes be α and 2α.

Then $\alpha+(2\alpha)=3\alpha=-\frac{b}{a} \quad \Rightarrow \alpha=-\frac{b}{3a} \quad \ldots$(i)

Also $\alpha(2\alpha)=\frac{c}{a}$

$\Rightarrow \left(-\frac{b}{3a}\right)\left\{2\left(-\frac{b}{3a}\right)\right\}=\frac{c}{a}$ [By (i)]

$\Rightarrow 2\left(\frac{b^2}{9a^2}\right)=\frac{c}{a}$

$\Rightarrow 2b^2=9ac$.

Q07. (A) Let $\alpha=\frac{3+\sqrt5}{5}$ and $\beta=\frac{3-\sqrt5}{5}$.

Then $\alpha+\beta=\frac{3+\sqrt5}{5}+\frac{3-\sqrt5}{5}=\frac{6}{5}$ and $\alpha\beta=\left(\frac{3+\sqrt5}{5}\right)\left(\frac{3-\sqrt5}{5}\right)=\frac{9-5}{25}=\frac{4}{25}$.

The required polynomial is $x^2-(\alpha+\beta)x+\alpha\beta=x^2-\frac{6}{5}x+\frac{4}{25}$.

Now we shall multiply by 25 to remove fractions.

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O.P. GUPTA
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VISHAL MINOCHA