|  |  | COMMON PRE-BOARD EXAMINATION 2022-23 <br> CLASS: X <br> SUBJECT: MATHEMATICS (241) <br> ANSWER KEY |  |
| :---: | :---: | :---: | :---: |
| Q.No |  | SECTION A | Marks |
| 1 | C |  | 1 |
| 2 | A |  | 1 |
| 3 | B |  | 1 |
| 4 | B |  | 1 |
| 5 | C |  | 1 |
| 6 | A |  | 1 |
| 7 | B |  | 1 |
| 8 | D |  | 1 |
| 9 | A |  | 1 |
| 10 | A |  | 1 |
| 11 | D |  | 1 |
| 12 | C |  | 1 |
| 13 | D |  | 1 |
| 14 | C |  | 1 |
| 15 | A |  | 1 |
| 16 | D |  | 1 |
| 17 | C |  | 1 |
| 18 | C |  | 1 |
| 19 | D |  | 1 |
| 20 | D |  | 1 |
|  |  | SECTION B |  |


| 21 | We have, $3 x=y+5$, and $5 x-y=11$ $\begin{array}{rlr} 3 x-y & =5  \tag{i}\\ 5 x-y & =11 \\ -\quad+ & - \\ \hline-2 x & =-6 \\ \hline \end{array}$ <br> ...[By subtracting <br> Putting the value of $x$ in (i), we get $\begin{aligned} & 3 x-y=5 \Rightarrow 3(3)-y=5 \\ & 9-5=y \Rightarrow y=4 \\ & \therefore x=3, y=4 \end{aligned}$ | $1 / 2$ <br> $1 / 2$ <br> $1 / 2$ <br> $1 / 2$ |
| :---: | :---: | :---: |
| 22 | In $\triangle \mathrm{APB}$ and $\triangle \mathrm{DPC}$, <br> $\angle 1=\angle 4 \ldots\left[\right.$ Each $\left.=90^{\circ}\right]$ <br> $\angle 2=\angle 3 \ldots$ [Vertically opp. $\angle$ s <br> $\therefore \triangle \mathrm{APB} \sim \triangle \mathrm{DPC} \ldots$ [AA similarity] <br> $\Rightarrow \mathrm{BP} / \mathrm{PC}=\mathrm{AP} / \mathrm{PD} \ldots$ [Sides are proportional] $\therefore \mathrm{AP} \times \mathrm{PC}=\mathrm{BP} \times \mathrm{PD}$ | $\begin{aligned} & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \end{aligned}$ |
| or | Let BC be the pole and EF be the tower Shadow $\mathrm{AB}=6 \mathrm{~m}$ and $\mathrm{DE}=30 \mathrm{~m}$. | Fig 1/2 |


|  | In $\triangle \mathrm{ABC}$ and $\triangle \mathrm{DEF}$, <br> $\angle 2=\angle 4 \ldots$ [Each $90^{\circ}$ ] <br> $\angle 1=\angle 3 \ldots$ [Sun's angle of elevation at the same time] <br> $\triangle \mathrm{ABC} \sim \triangle \mathrm{DEF} \ldots$ [AA similarity] <br> $\mathrm{AB} / \mathrm{DE}=\mathrm{BC} / \mathrm{EF} . .$. [In -As corresponding sides are proportional] $\begin{aligned} & \Rightarrow 6 / 30=8 / E F \\ & \therefore \mathrm{EF}=40 \mathrm{~m} \end{aligned}$ | $\begin{aligned} & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \end{aligned}$ |
| :---: | :---: | :---: |
| 23 | $\begin{aligned} & \mathrm{AP}=\mathrm{AR}=4 \mathrm{~cm} \\ & \mathrm{RC}=11-4=7 \mathrm{~cm} \\ & \mathrm{RC}=\mathrm{QC}=7 \mathrm{~cm} \\ & \mathrm{BQ}=\mathrm{BP}=3 \mathrm{~cm} \\ & \mathrm{BC}=\mathrm{BQ}+\mathrm{QC} \\ & =3+7=10 \mathrm{~cm} \end{aligned}$ | $1 / 2$ <br> $1 / 2$ <br> $1 / 2$ <br> $1 / 2$ |
| 24 | $\begin{aligned} & \text { Here } \theta=\frac{360^{\circ}}{60 \mathrm{~m}} \times 5 \mathrm{~m}=30^{\circ} \ldots[\because 1 \text { hour }=60 \text { minutes } \\ & r(\text { radius })=14 \mathrm{~cm} \\ & \begin{aligned} \therefore \text { Required area } & =\frac{\theta}{360} \pi r^{2} \\ & =\frac{30}{360} \times \frac{22}{7} \times 14 \times 14 \\ & =\frac{154}{3} \mathrm{~cm}^{2} \text { or } 51 . \overline{3} \mathrm{~cm}^{2} \end{aligned} \end{aligned}$ | $1 / 2$ $1 / 2$ $1 / 2$ $1 / 2$ $1 / 2$ |


| OR | Circumference of a circle $=22 \mathrm{~cm} 2 \pi \mathrm{r}=22 \mathrm{~cm}$ $\begin{aligned} & 2 \times \frac{22}{7} \times r=22 \mathrm{~cm} \\ & r=\frac{22 \times 7}{22 \times 2}=\frac{7}{2} \mathrm{~cm} \\ & \therefore \quad \text { Area of quadrant }=\frac{1}{4} \pi r^{2} \\ &=\frac{1}{4} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}=\frac{77}{8} \mathrm{~cm}^{2} \end{aligned}$ | $\begin{aligned} & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \end{aligned}$ |
| :---: | :---: | :---: |
| 25 | $\mathrm{PQ}^{2}+\mathrm{QR}^{2}=\mathrm{PR}^{2} \ldots[$ By Pythogoras' theorem $]$ $\left.\begin{aligned} & (6)^{2}+\mathrm{QR}^{2}=(12)^{2} \\ & \mathrm{QR}^{2}=144-36 \\ & \mathrm{QR}^{2}=108 \\ & \mathrm{QR}=\sqrt{36 \times 3}=6 \sqrt{3} \mathrm{~cm} \\ & \tan \mathrm{R}=\frac{\mathrm{PQ}}{\mathrm{QR}} \\ & \\ & \tan \mathrm{R}=\frac{6}{6 \sqrt{3}}=\frac{1}{\sqrt{3}} \\ & \tan \mathrm{P}=\frac{\mathrm{QR}}{\mathrm{PQ}} \\ & \tan \mathrm{P}=\tan 30^{\circ} \\ & \mathrm{R}=30^{\circ} \\ & \angle \mathrm{tan} \\ & \angle \mathrm{PRQ}=30^{\circ} \end{aligned} \right\rvert\, \begin{aligned} & \mathrm{P}=60^{\circ} \\ & \angle \mathrm{APR}=60^{\circ} \end{aligned}$ | Each <br> angle <br> 1/2 |
| 26 | Let us assume to the contrary, that $3+2 \sqrt{3}$ is rational. So that we can find integers a and $\mathrm{b}(\mathrm{b} \neq 0)$. | 1/2 |

\begin{tabular}{|c|c|c|}
\hline \& \begin{tabular}{l}
Such that \(3+2 \sqrt{3}=a / b\), where \(a\) and \(b\) are coprime. \\
Rearranging the equations, we get
\[
\begin{aligned}
\& 2 \sqrt{3}=\frac{a}{b}-3=\frac{a-3 b}{b} \\
\& \sqrt{3}=\frac{a-3 b}{2 b}=\frac{a}{2 b}-\frac{3 b}{2 b} \\
\& \sqrt{3}=\frac{a}{2 b}-\frac{3}{2}
\end{aligned}
\] \\
Since a and b are integers, we get \(\mathrm{a} / 2 \mathrm{~b}-3 / 2\) is rational and so \(\sqrt{3}\) is rational. \\
But this contradicts the fact that \(\sqrt{ } 3\) is irrational. \\
So we conclude that \(3+2 \sqrt{ } 3\) is irrational.
\end{tabular} \& \(1 / 2\)
\(1 / 2\)

$1 / 2$
$1 / 2$
$1 / 2$ \\

\hline 27 \& $$
\begin{aligned}
& f(x)=x^{2}-4 x+3 \\
& \alpha+\beta=4 \\
& \alpha \beta=3 \\
& \alpha^{2}+\beta^{2}=10 \\
& \alpha^{4} \beta^{2}+\alpha^{2} \beta^{4}=\alpha^{2} \beta^{2}\left(\alpha^{2}+\beta^{2} .\right) \\
& =3^{2} \times 10=90
\end{aligned}
$$ \& $1 / 2$

$1 / 2$
1
$1 / 2$
$1 / 2$ \\

\hline 28 \& | Let the digit in the ones place be x and tens place be y |
| :--- |
| Hence the two digit number $=10 y+x$ |
| Given that the two digit number $=4$ times sum of its digits $\begin{aligned} & 10 y+x=4(x+y) \\ & 10 y+x=4 x+4 y \\ & 3 x-6 y=0 \\ & 3 x=6 y \\ & x=2 y \rightarrow(1) \end{aligned}$ |
| It is also given that the two digit number $=2$ times product of its digits $\begin{equation*} 10 y+x=2 x y \quad-> \tag{2} \end{equation*}$ |
| Solving 1 and 2 we get | \& $1 / 2$

$1 / 2$

$1 / 2$ \\
\hline
\end{tabular}

|  | $y=2, x=6$ <br> The two digit number is $(10 y+x)=10(3)+6=36$ | $\begin{aligned} & \hline 1 \\ & 1 / 2 \end{aligned}$ |
| :---: | :---: | :---: |
| OR | Let the speed of the first car starting from $A$ be $x \mathrm{~km} / \mathrm{hr}$ and the speed of the second car starting from B be y km/hr. <br> Let the cars meet at point P when they are moving in the same direction and at point Q when they are moving in the opposite direction. <br> When they travel in the same direction, they meet in 7 hours. <br> Distance travelled by the first car in 7 hours $\mathrm{AP}=7 \mathrm{xx} \mathrm{km}=7 \mathrm{x} \mathrm{km}$. <br> Distance travelled by the second car in 7 hours BP=7xy km=7y km AP-BP $=7 x-7 y=70$ <br> $7(x-y)=7 \times 10$ <br> $x-y=10$ <br> When they travel in the opposite direction, they meet after 1 hour. <br> Distance travelled by the first car in 1 hour $\mathrm{AQ}=1 \times x \mathrm{~km}=\mathrm{x}$. <br> Distance travelled by the second car in 1 hour $\mathrm{BQ}=1 \times \mathrm{ym}=\mathrm{y} \mathrm{km}$ <br> $x+y=70$ <br> Solving equations i and ii , $x=40 ; y=30$ <br> Therefore, the speed of the first car is $40 \mathrm{~km} / \mathrm{hr}$ and the speed of the second car is $30 \mathrm{~km} / \mathrm{hr}$. | $\begin{array}{cc}1 / 2 \\ 1 / 2 \\ \\ & \\ 1 \\ 1 & \\ 1\end{array}$ |

\begin{tabular}{|c|c|c|}
\hline 29. \& \begin{tabular}{l}
Fig. 1 \\
using Pythagoras theorem
\[
\begin{aligned}
\& \quad A C^{2}=A B^{2}+B C^{2} \\
\& A C^{2}=(14)^{2}+(48)^{2} \\
\& A C=50 \mathrm{~cm} \\
\& \text { area of } A B C=\text { area of } \triangle A O B+\text { area of } \triangle B O C \\
\& + \text { area of } \triangle A O C \\
\& \quad \frac{1}{2} \times b \times h=\frac{1}{2} \times b_{1} \times h_{1}+\frac{1}{2} \times b_{2} \times h_{2}+\frac{1}{2} \times b_{3} \times h_{3} \\
\& 14 \times 48=14 \times r+48 \times r+50 \times r \\
\& 56 r=336 \\
\& r=336 / 56 \\
\& =r=6 \mathrm{~cm}
\end{aligned}
\] \\
Radius \(r\) of in circle is 6 cm
\end{tabular} \& 1
1
1

1 \\
\hline 30 \& \& \\
\hline
\end{tabular}

|  | $\begin{aligned} & =(1+\tan A+\sec A)(1+\cot A-\operatorname{cosec} A) \\ & =\left(1+\frac{\sin A}{\cos A}+\frac{1}{\cos A}\right)\left(1+\frac{\cos A}{\sin A}-\frac{1}{\sin A}\right) \\ & =\left(\frac{\cos A+\sin A+1}{\cos A}\right)\left(\frac{\sin A+\cos A-1}{\sin A}\right) \\ & =\frac{(\cos A+\sin A)^{2}-1}{\sin A \cos A} \frac{\cos ^{2} A+\sin ^{2} A+2 \cos A \sin A-1}{\sin A \cos A} \\ & =\frac{2 \sin A \cos A}{\sin A \cos A}=2=R H S \end{aligned}$ | 1 <br> $1 / 2$ <br> 1 <br> $1 / 2$ |
| :---: | :---: | :---: |
| OR | We have, $\frac{\cos \theta-\sin \theta}{\cos \theta+\sin \theta}=\frac{1-\sqrt{3}}{1+\sqrt{3}} \quad \Rightarrow \frac{\frac{\cos \theta-\sin \theta}{\cos \theta}}{\frac{\cos \theta+\sin \theta}{\cos \theta}}=\frac{1-\sqrt{3}}{1+\sqrt{3}}$ <br> [Dividing numerator \& denominator of the LHS by $\cos \theta$ ] $\begin{aligned} & 1-\tan \theta / 1+\tan \theta=1-\sqrt{3} / 1+\sqrt{3} \\ & \operatorname{Tan} \theta=\tan 60^{\circ} \\ & \theta=60^{\circ} \end{aligned}$ | 1 <br> 1 <br> $1 / 2$ <br> $1 / 2$ |
| 31. | i) $15 / 36$ Or $5 / 12$ <br> ii) $25 / 36$ <br> iii) $3 / 36$ or $1 / 12$ | Each 1 mark |
| 32 | Let the marks obtained in mathematics be $x$ then marks in science be $28-\mathrm{x}$ from given condition, $\begin{aligned} & (\mathrm{x}+3)(28-\mathrm{x}-4)=180 \\ & \Rightarrow(\mathrm{x}+3)(24-\mathrm{x})=180 \end{aligned}$ | 1/2 |


|  | $\begin{aligned} & 24 \mathrm{x}-\mathrm{x}^{2}+72-3 \mathrm{x}=180 \\ & 21 \mathrm{x}-\mathrm{x}^{2}-180+72=0 \\ & \mathrm{x}^{2}-21 \mathrm{x}+108=0 \\ & \mathrm{x}^{2}-12 \mathrm{x}-9 \mathrm{x}+108=0 \\ & \Rightarrow \mathrm{x}(\mathrm{x}-12)-9(\mathrm{x}-12)=0 \\ & \Rightarrow(\mathrm{x}-9)(\mathrm{x}-12)=0 \\ & \therefore \mathrm{x}=9,12 \end{aligned}$ <br> the marks scored in Maths can be 9 or 12 . if she got 12 in Maths then she got $28-12=16$ in science if she got 9 in Maths then she got 28-9=19 in science | 1/2 ${ }^{1 / 2}$ |
| :---: | :---: | :---: |
| or | Let the speed of faster train be $\mathrm{xkm} / \mathrm{h}$. <br> Then, the speed of slower train is $(x-10) \mathrm{km} / \mathrm{h}$. <br> Given: <br> A faster train takes one hour less than a slower train for a journey of 200 km . <br> Distance $/$ Speed=Time <br> Time taken by faster train to cover $200 \mathrm{~km}=200 / \mathrm{x} \mathrm{h}$ <br> Time taken by slower train to cover $200 \mathrm{~km}=200 / \mathrm{x}-10 \mathrm{~h}$ <br> According to the question, $\begin{aligned} & 200 / x-10-200 / x=1 \\ & x^{2}-10 x-2000=0 \\ & x^{2}-50 x+40 x-2000=0 \\ & (x-50)(x+40)=0 \\ & x=50,-40 \end{aligned}$ <br> But x is the speed of the train ,which is always positive. <br> Thus, $x=50$ <br> and $\mathrm{x}-10=40$ <br> Hence, the speed of fast train is $50 \mathrm{~km} / \mathrm{h}$ and the speed of slow train is 40 $\mathrm{km} / \mathrm{h}$. | (1/2 |


|  |  | 1 |
| :---: | :---: | :---: |
| 33. | BASIC PROPORTIONALITY THEOREM <br> GIVEN <br> TO PROVE <br> FIGURE - 1 MARK <br> PROOF 3 MARKS <br> ANSWER FOR QUESTION: $\begin{equation*} \Rightarrow \quad \frac{B D}{D A}=\frac{B E}{E C} \quad(\mathrm{By} \mathrm{BPT}) \tag{i} \end{equation*}$ <br> In $\triangle A B L D C \\| A L$ $\begin{equation*} \Rightarrow \quad \frac{B D}{D A}=\frac{B C}{C L} \tag{ii} \end{equation*}$ <br> (By BPT) <br> Fig. 7.32 $\frac{B E}{E C}=\frac{B C}{C L} \Rightarrow \frac{4}{2}=\frac{6}{C L} \quad \Rightarrow \quad C L=3 \mathrm{~cm}$ |  |
| 34 | Solution <br> Given- Radius of cylinder $=3.5 \mathrm{~cm}$ and height $=10 \mathrm{~cm}$ <br> Total surface area of Article $=$ Curved surface area of cylinder + Curved surface area of two hemispheres <br> Curved surface area of cylinder $\begin{aligned} & =2 \pi \mathrm{rh} \\ & =2 \pi \times 3.5 \times 10 \end{aligned}$ | 1 $1 / 2$ $1 / 2$ |


|  | $=70 \pi$ <br> Surface area of a hemisphere $\begin{aligned} & =2 \pi r^{2} \\ & =2 \pi \times 3.5 \times 3.5 \\ & =24.5 \pi \end{aligned}$ <br> Hence, Total surface area of article $=70 \pi+2 \times(24.5 \pi)$ $=70 \pi+49 \pi$ $=119 \pi$ $=119 \times 227=374 \mathrm{~cm}^{2}$ | $\begin{aligned} & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \end{aligned}$ $1$ |
| :---: | :---: | :---: |
| OR | Diameter of cylinder $=7 \mathrm{~cm}$ <br> Height of cylinder $=20-7=13 \mathrm{~cm}=\mathrm{H}$ <br> Total Volume $=\pi R^{2} H+\frac{4}{3} \pi R^{3} \mathrm{~cm}^{2}$ $\begin{aligned} & =\pi\left(\frac{7}{2}\right)^{2} \cdot 13+\frac{4}{3} \pi\left(\frac{7}{2}\right)^{3} \\ & =\frac{22}{7} \times \frac{49}{4}\left(13+\frac{4}{3} \cdot \frac{7}{2}\right) \mathrm{cm}^{3} \\ & =\frac{77 \times 53}{6} \\ & =680.17 \mathrm{~cm}^{3} \end{aligned}$ | Fig $1 / 2$ <br> 1 <br> 1 <br> 1 <br> 1 <br> $1 / 2$ |



| 36 | $\begin{aligned} & \text { i) } 51,49,47 \ldots \\ & \text { ii) } 11 \\ & \text { iii) first term }=5 \\ & \text { second term }=7 \\ & \text { common difference }=7-5=2 \\ & \text { or } \\ & 2 x, x+10,3 x+2 \text { are in AP. } \\ & 2(x+10)=2 x+(3 x+2) \\ & 2 x+20=5 x+2 \\ & 3 x=18 \\ & x=6 . \end{aligned}$ | 1 <br> 1 <br> $1 / 2$ <br> $1 / 2$ <br> 1 <br> $1 / 2$ <br> $1 / 2$ <br> 1 |
| :---: | :---: | :---: |
| 37. | i) $(6,12)$ <br> i) $4 \sqrt{10}$ <br> iii) $\mathrm{AR}: \mathrm{BR}=3: 2$ $\begin{aligned} & \mathrm{x} \text { coordinate }=3(22)+2(22) / 5 \\ & =22 \end{aligned}$ <br> Or <br> Let S divides MN in the ratio $\mathrm{m}: 1$ $\begin{aligned} & 20=24 \mathrm{~m}+4 / \mathrm{m}+1 \\ & \mathrm{~m}=4 \\ & \text { ratio is } 4: 1 \end{aligned}$ | $\begin{aligned} & \hline 1 \\ & 1 \\ & 1 / 2 \\ & 1 \\ & 1 / 2 \\ & \\ & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \\ & 1 / 2 \end{aligned}$ |


| 38. | i) 400 m | 1 |
| :--- | :--- | :--- |
| ii) $45^{0}$ | 1 |  |
| iii) $\tan 30^{0}=\mathrm{AB} / \mathrm{BC}$ | $1 / 2$ |  |
| $1 / \sqrt{3}=\mathrm{AB} / 15$ | $1 / 2$ |  |
| $\mathrm{AB}=15 / \sqrt{3}$ |  |  |
| $=5 \sqrt{3}$ | $1 / 2$ |  |
| OR |  |  |
| $\mathrm{AB}=6 \mathrm{~m}$ | $1 / 2$ |  |
| $\mathrm{AC}=6 \sqrt{2} \mathrm{~m}$ | 1 |  |

