CBSE Board Paper Solution-2020

Class	: X
Subject	: Science
Set	: 1
Code No	: 31/4/1
Time Allowed	: 3 Hours
Maximum Marks	: 80

General Instructions:

Read the following instructions very carefully and strictly follow them :

(i)   This question paper comprises **three** sections–A, B, and C. There are **30** questions in the question paper. All questions are compulsory.

(ii) **Section A :** Question no. **1** to **14** all questions or part thereof are of **one** mark each. These questions comprise Multiple Choice Questions (MCQ), Very Short Answer (VSA) and Assertion-Reason type questions. Answer to these questions should be given in **one word** or **one sentence.**

(iii) **Section B :** Question no. **15** to **24** are short answer type questions, carrying **3** marks each. Answer to these questions should not exceed **50** to **60** words.

(iv) **Section C :** Question no. **25** to **30** are long answer type questions, carrying **5** marks each. Answer to these questions should not exceed **80** to **90** words.

(v) Answers should be brief and to the point. Also the above mentioned word limit be adhered to as far as possible.

(vi) There is no overall choice in the question paper. However, an internal choice has been provided in some questions in each section. **Only one of the choices** in such questions have to be attempted.

(vii) In addition to this, separate instructions are given with each section and question, wherever necessary.

SECTION-A

1. **Write the number of valence electrons present in a nitrogen atom** $\left(\begin{array}{c} 14 \\ 7 \end{array} N\right)$. **[1]**

   Answer: Five

2. **Define the term induced electric current.** **[1]**

   Answer: The electric current induced in a conductor due to the change in magnetic field is known as induced current.

3. **Answer question number 3(a) – 3(d) on the basis of your understanding of the following paragraph and the related studied concepts.**

   Around the year 1800, only 30 elements were known. Dobereiner in 1817 and Newlands in 1866 tried to arrange the then known elements and framed laws which were rejected by the scientists. Even after the rejection of the proposed laws, many scientists continued to search for a pattern that correlated the properties of elements with their atomic masses.

   The main credit for classifying elements goes to Mendeleev for his most important contribution to the early development of a Periodic table of element wherein the arranged the elements on the basis of their fundamental property, the atomic mass and also on the similarity of chemical properties. The formulae of their

hydrides and oxides were treated as basic criteria for the classification of the elements.

However, Mendeleev's classification also had some limitations as it could not assign the position to isotopes. He also left some gaps in the periodic table.

3(a) State Mendeleev's Periodic Law.   [1]

3(b) Why did Mendeleev leave some gaps in the Periodic table?   [1]

3(c) If the letter 'R' was used to represent any of the elements in the group, then the hydride and oxide of carbon would respectively be represented as

   (i) RH_4, RO
   (ii) RH_4, RO_2
   (iii) RH_2, RO_2
   (iv) RH_2, RO [1]

3 (d) Isotopes are

   (i) Atoms of an element with similar chemical properties but different atomic masses.
   (ii) Atoms of different elements with similar chemical properties but different atomic masses.
   (iii) Atoms of an element with different chemical properties but same atomic masses.

(iv) Atoms of different elements with different chemical properties but same atomic masses.

[1]

Answer:

(a) According to the Mendeleev's periodic law, the physical and chemical properties of elements are periodic function of their atomic masses.

(b) Mendeleev predicted the existence and the properties of some elements, which were not known at that time. Therefore, he left some gaps in the Periodic table.

(c) (ii)

(d) (i)

4. **Answer question numbers 4 (a) - 4 (d) on the basis of your understanding of the following paragraph and the related studies concepts-**

India today is facing the problem of overuse of resources, contamination of water and soil and lack of methods of processing the waste. The time has come for the world to say goodbye to "single-use plastics". Steps must be undertaken to develop environment- friendly substitutes, effective plastic waste collection and methods of its disposal.

Indore treated 15 lakh metric tonnes of waste in just 3 years, through biomining and bioremediation techniques. Bioremediation

involves introducing microbes into a landfill to naturally 'break' it down and biomining involves using trammel machines to sift through the waste to separate the 'soil' and the waste component. The city managed to chip away 15 lakh metric tonnes of waste at a cost of around Rs 10 crore. A similar experiment was successfully carried out in Ahmedabad also.

4(a) State two methods of effective plastic waste collection in your school.   [1]

4(b) Name any two uses of "single use plastic" in daily life.   [1]

4(c) If we discontinue the use of plastic, how can an environment-friendly substitute be provided?   [1]

4(d) Do you think microbes will work similarly in landfill sites as they work in the laboratory? Justify your answer.   [1]

Answer: (a) Two methods of effective plastic waste collection in the school are-

i.   Curbside Recycling
ii.   Drop-Off Recycling

(b) Two uses of "single use plastic" in daily life are-

i. Plastic grocery bags
ii. Plastic drinking bottles

(c) If we discontinue the use of plastic, we can use long-lasting environment-friendly substitutes like stainless steel or glass water bottles, reusable shopping bags, eco-friendly cutlery etc.

(d) Yes, microbes can work in landfill sites as they work in laboratory. The landfills can be broken down naturally by the process of bioremediation that involves the microbes.

5. **Which of the following statement is correct about the human circulatory system?**

   (A) Blood transports only oxygen and not carbon dioxide.
   (B) Human heart has five chambers.
   (C) Valves ensure that the blood does not flow backwards.
   (D) Both oxygen-rich and oxygen-deficient blood gets mixed in the heart.

   [1]

   Answer: (C)

   Explanation: Blood can flow from the atria down into the ventricles. Valves open in one direction like trapdoors to let the blood pass through. Then they close, so the blood cannot flow backwards into the atria.

6. **Anaerobic process**

   (A) takes place in yeast during fermentation.
   (B) takes place in the presence of oxygen.
   (C) produces only energy in the muscles of human beings.

(D) Produces ethanol, oxygen and energy.

[1]

Answer: (A)

Explanation: In yeast, anaerobic fermentation takes places in the presence of sugar but absence of oxygen. Anaerobic fermentation in yeast results in the production of ethanol and carbon dioxide.

OR

Most of the digestion and absorption of the food takes place in the

(A) small intestine.
(B) liver.
(C) stomach.
(D) large intestine.

[1]

Answer: (A)

Explanation: The small intestine is the part of digestive system where much of the digestion and absorption of food takes place. The primary function of the small intestine is to absorb nutrients and minerals present in the food.

7. Fertilisation is the process of
(A) transfer of male gamete to female gamete.
(B) fusion of nuclei of male and female gamete.
(C) adhesion of male and female reproductive organs.
(D) the formation of gametes by a reproductive organ.

[1]

Answer: (B)

Explanation: Fertilisation is the process of fusion of haploid gametes, (male and female) to form the diploid zygote.

8. **If a person has five resistors each of value $\frac{1}{5}$ Ω, then the maximum resistance he can obtain by connecting them is** **[1]**

   (A) 1 Ω

   (B) 5 Ω

   (C) 10 Ω

   (D) 25 Ω

   Answer: (A)

   Series combination of resistors gives maximum resistance

   $R_{equivalent} = R_1 + R_2 + R_3 + R_4 + R_5$

   $R_{equivalent} = \dfrac{1}{5\ \Omega} + \dfrac{1}{5\ \Omega} + \dfrac{1}{5\ \Omega} + \dfrac{1}{5\ \Omega} + \dfrac{1}{5\ \Omega} = 1\ \Omega$

   OR

   The resistance of a resistor is reduced to half of its initial value. In doing so, if other parameters of the circuit remain unchanged, the heating effects in the resistor will become

   [1]

   (A) two times.

(B) half.

(C) one-fourth.

(D) four times.

Answer: (B)

Joule's law of heating is given by $H = I^2RT$

If other parameters remain constant, the amount of heat produced, H is directly proportional to R.

9. **Fleming Right-hand rule gives** [1]

   (A) magnitude of the induced current.

   (B) magnitude of the magnetic field.

   (C) direction of the induced current.

   (D) both, direction and magnitude of the induced current.

   Answer: (C)

   Fleming's right-hand rule states that if we stretched our right hand's thumb, index finger and middle finger in such a way so that all three are mutually perpendicular, thumb shows the direction of motion of conductor with respect to magnetic field, index finger shows the direction of magnetic field than middle finger shows the direction of induced current in the conductor.

10. **Which one of the following statements is not true about nuclear energy generation in a nuclear reactor?** [1]

    (A) Energy is obtained by a process called nuclear fission.

(B) The nucleus of Uranium is bombarded with high energy neutrons.

(C) A chain reaction is set in the process.

(D) In this process a tremendous amount of energy is released at a controlled rate.

Answer: (B)

Slow moving neutrons are bombarded on the nucleus of Uranium to break the nucleus in smaller stable nuclei.

OR

The biggest source of energy on Earth's surface is **[1]**

(A) Biomass

(B) Solar radiations

(C) Tides

(D) Winds

Answer: (B)

Maximum energy present on the earth is converted form of solar energy.

11. **Food web is constituted by** **[1]**

(A) relationship between the organism and the environment.

(B) relationship between plants and animals.

(C) various interlinked food chains in an ecosystem.

(D) relationship between animals and environment.

Answer: (C)

In a food web, many food chains are linked together. Thus, it is a network of interlinked food chains in an ecosystem. In this network, every organism is eaten by more than one organism, who are again eaten by other different organisms. Unlike a food chain, the food web is represented by the crisscross pattern of lines.

12. **Choose the incorrect statement from the following:**

[1]

(A) **Ozone is a molecule formed by three atoms of oxygen.**

(B) **Ozone shields the surface of the Earth from ultraviolet radiations.**

(C) **Ozone is deadly poisonous.**

(D) **Ozone gets decomposed by UV radiations.**

Answer: (D)

Ozone (O_3) is an inorganic molecule made up of three oxygen atoms. It is not decomposed by UV (ultraviolet) radiations, rather these radiations help in the formation of ozone.

The chemical reaction involved in ozone formation is as follows:

O₂ (Diatomic Oxygen) → (UV) → O + O (Monoatomic Oxygen)

O + O₂ → O₃ (Triatomic Oxygen (Ozone))
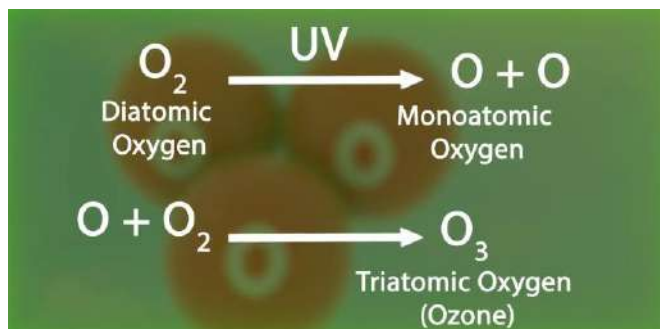
13. For question numbers 13 and 14, two statements are given- one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

  (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion (A).
  (b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion (A).
  (c) (A) is true, but (R) is false.
  (d) (A) is false, but (R) is true.

  Assertion (A): Following is a balanced chemical equation for the action of steam on iron:

  $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
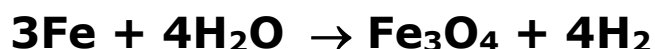
  Reason (R): The law of conservation of mass holds good for a chemical equation.

  [1]

  Answer: (a)

14. Assertion (A): The sex of a child in human beings will be determined by the type of chromosome he/she inherits from the father.

Reason (R): A child who inherits 'X' chromosome from his father would be a girl (XX), while a child who inherits a 'Y' chromosome from the father would be a boy (XY). [1]

Answer: (a) Both (A) and (R) are true and ® is the correct explanation of the assertion (A).

All human beings have 23 pairs of chromosomes in the nuclei of their cells. Out of these two are the sex chromosomes named as X and Y.

A female has two X chromosomes while male has one X and one Y chromosome.

If the sperm containing X chromosome fertilize the egg. The zygote will contain two X sex chromosomes. This zygote will develop into a female child.

If the sperm has Y chromosome and it fertilizes the egg the zygote. The zygote will develop into the male child.

Hence, the type of sperm contributed by father determines the sex of the unborn baby.

SECTION-B

15. **Lead nitrate solution is added to a test tube containing potassium iodide solution.**

   (a) Write the name and colour of the compound precipitated.

(b) Write the balanced chemical equation for the reaction involved.

(c) Name the type of this reaction justifying your answer.

[3]

Answer:

(a) Name of compound precipitated: Lead iodide

Colour of the compound precipitated: Yellow

(b) $2KI(s) + Pb(NO_3)_2(aq) \longrightarrow 2KNO_3(aq) + PbI_2(s)$

(c) This is a double displacement reaction because in the reaction two compounds exchange their ions to form two new compounds. Here both lead nitrate and potassium iodide are exchanging their ions.

OR

What happens when food materials containing fats and oils are left for a long time/ List two observable changes and suggest three ways by which this phenomenon can be prevented. **[3]**

Answer: When food materials containing fats and oils are left for a long time they undergo oxidation and their **taste** and **smell change**.

This can be prevented by–

1. Using airtight and light protecting packing
2. Using antioxidants like vitamin A and C
3. Filling nitrogen gas in chips container

16. List three differentiating features between the processes of galvanisation and alloying. [3]

Answer:

Galvanisation	Alloying
Galvanisation is the process of depositing a thin layer of zinc metal on iron objects to protect them for rusting.	A homogeneous mixture of two or more metals or a metal and a non-metal to change the properties of pure state metals and protect them from rust.
It can be done by spraying molten zinc on the iron surface and dipping iron objects into molten zinc.	It can be done by alloying iron object with the chromium and nickel.
It does not affect the properties of iron (metal).	It changes the hardness, tensile strength and electrical resistance of a metal.

OR

Compare in tabular form the reactivities of the following metals with cold and hot water:

(a) Sodium

(b) Calcium

(c) Magnesium [3]

Answer:

Metal	Reactivity	Reactions
Sodium (Na)	It reacts vigorously	$2Na(s) + 2H_2O(l) \longrightarrow 2NaOH(aq) + H_2(g)$

	with cold water.	
Calcium (Ca)	It reacts slowly with cold water and moderately with hot water.	$Ca(s) + 2H_2O(l) \longrightarrow Ca(OH)_2 + H_2(g)$ (Hot)
Magnesium (Mg)	Magnesium does not react with cold water. It reacts slowly with hot water and vigorously with steam.	$Mg(s) + 2H_2O(l) \longrightarrow Mg(OH)_2 + H_2(g)$ (Hot) $Mg(s) + H_2O(l) \longrightarrow MgO + H_2(g)$ (Steam)

17. Carbon, a member of group14, forms a large number of carbon compounds estimated to be about three million. Why is this property not exhibited by other elements of this group? Explain. [3]

Answer:

1. **Tetravalency:** Carbon can easily form four covalent bonds to other atoms.

2. **Catenation:** Carbon can easily form covalent bonds to other carbon atoms and the carbon-carbon bonds are more stable than the other

element to same element bonds formed by other member of group 14.

3. **Formation of multiple bonds:** Carbon can form not only a single bond but also it can form double or single bonds with same or different elements.

Since these properties are not exhibited by other elements of this group, therefore, the number of carbon compounds is very large as compared to the other elements of group 14.

18. **A cheetah, on seeing a prey, moves towards him at a very high speed. What causes the movement of his muscles? How does the chemistry of cellular components of muscles change during this event?** **[3]**

Answer: A cheetah possesses an extremely flexible spine which allows for extreme flexion and extension while moving towards a prey at a very high speed.

Rapid respiration is required for a high-intensity output of the chasing activity. Thus, a cheetah consequently respires anaerobically. During anaerobic respiration, partial breakdown of glucose takes place, which leads to the accumulation of lactic acid in the muscles as the end-product.

19. **Define geotropism. Draw a labelled diagram of a plant showing geotropic movement of its parts.** **[3]**

Answer: <u>Geotropism:</u> Geotropism refers to the growth of the parts of a plant in response to gravity.
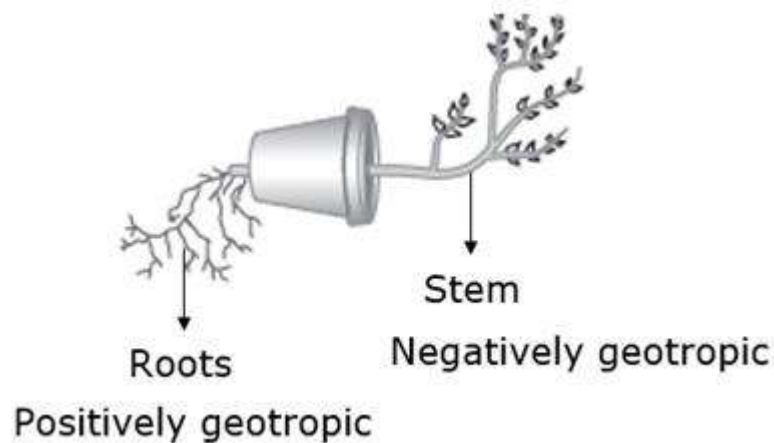
Figure: A plant showing geotropic movement

20. **Define the term evolution. "Evolution cannot be equated with progress." Justify this statement.**

[3]

Answer: Evolution is the gradual and continuous changes in the traits of an individual that accumulates and enables it to survive better in its surroundings.

Evolution cannot be equated with progress from lower organisms to higher organisms. Evolution leads to the production of diversity and the shaping this diversity by environmental selection. In addition, even the simpler life forms continue to flourish as we can see in case of bacteria. These are one of the simplest life form that inhabit in extreme cold or hot conditions.

OR

"During the course of evolution, organs or features may be adapted for new functions."

Explain this fact by choosing an appropriate example. **[3]**

Answer: The organs or features adapted for new functions during evolution are:

(i) Some dinosaur had feathers for insulation in cold weather but in case of birds they were used for flying.

(ii) Older life forms, such as bacteria were able to survive in most of the inhospitable habitats like, hot springs, deep-sea, thermal vents and the ice in Antarctica.

21. **A concave mirror is use for image formation for different positions of an object. What inferences can be drawn about the following when an object is placed at a distance of 10 cm from the pole of a concave mirror of focal length 15 cm?**

    (A) Position of the image

    (B) Size of the image

    (C) Nature of the image

    Draw a labelled ray diagram to justify your inferences. **[3]**

    Answer: Given,

    Position of object, u = – 10 cm

    Focal length of concave mirror, f = –15 cm

(a) Using mirror formula,

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{-15 \text{ cm}} - \frac{1}{(-10 \text{ cm})} = \frac{1}{30 \text{ cm}}$$

$$\Rightarrow \quad v = 30 \text{ cm}$$

So, the position of image is 30 cm behind the mirror.

(b) Using magnification formula, $m = \dfrac{h_i}{h_o} = -\dfrac{v}{u}$

$$\Rightarrow \quad \frac{h_i}{h_o} = -\frac{30 \text{ cm}}{(-10 \text{ cm})} = 3 \text{ cm}$$

$$\Rightarrow \quad h_i = 3h_o$$

So, the size of the image is three times that of the size of the object.

Here the object is placed in between focus and pole of the concave mirror, so the image formed will be virtual and magnified.
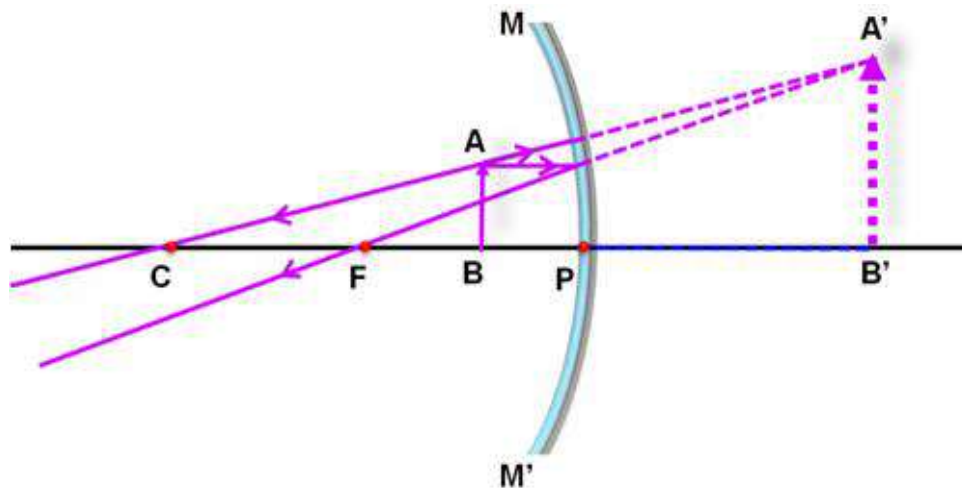
22. The refractive index of a medium 'x' with respect to a medium 'y' is 2/3 and the refractive index of medium 'y' with respect to medium 'z' is 4/3. Find the refractive index of medium 'z' with respect to medium 'x'. If the speed of light in medium 'x' is 3×10^8 ms^{-1}, calculate the speed of light in medium 'y' **[3]**

Answer:

Given :

Refractive index of medium 'x"

with respect to medium 'y', $\mu_{xy} = \dfrac{2}{3}$

Refractive index of medium 'y"

with respect to medium 'z', $\mu_{yz} = \dfrac{4}{3}$

Refractive index of medium 'z"
with respect to medium 'x',

$$\mu_{zx} = \frac{1}{\mu_{xy} \times \mu_{yz}} = \frac{1}{\dfrac{2}{3} \times \dfrac{4}{3}} = \frac{9}{8}$$

Refractive index of medium 'z"

with respect to medium 'x' is $\dfrac{9}{8}$.

Speed of light in medium 'y',

$$v = c \times \mu_{xy} = 3 \times 10^8 \text{ m/s} \times \frac{2}{3} = 2 \times 10^8 \text{ m/s}$$

23. A person may suffer from both myopia and hypermetropia defects.

(a) What is this condition called?

(b) When does it happen?

(c) Name the type of lens often required by the suffering from this defect. Draw labelled diagram of such lenses. **[3]**

**Answer:**

(a) This condition is called presbyopia.

(b) It happens in old age.

(c) Bifocal lens is required for clear vision by the person suffering from presbyopia.
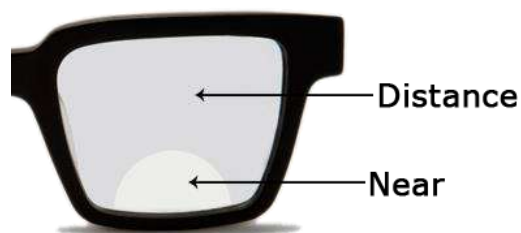
24. How will you use two identical glass prisms so that a narrow beam of white light incident on one prism emerges out of the second prism as white light? Draw and label the ray diagram.[3]

Answer: One glass prism must be placed in inverted position with respect to other, when white light passes through first prism, dispersion happens and white light splits into seven colour. When these colour light falls on the inverted prism, then light of seven colours combine to give white light.

Glass Prism (P$_2$)

Recombination

White light

White light

Glass Prism (P$_1$)
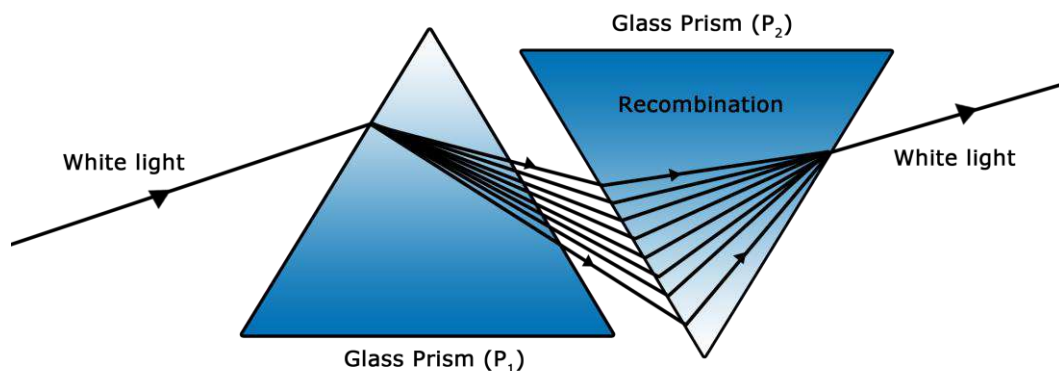
SECTION-C

25. A cloth strip dipped in onion juice is used for testing a liquid 'X'. The liquid 'X' changes its odour. Which type of an indicator is onion juice? 'The liquid 'X' turns blue litmus red. List the observations the liquid 'X' will show on reacting with the following:
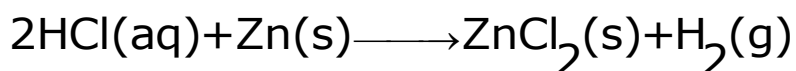
(a) Zinc granules

(b) Solid sodium carbonate

Write the chemical equations for the reactions involved.   [5]

Answer: Onion juice is an olfactory indicator. Since the liquid 'X' turns blue litmus red, therefore, it is an acid.

(a) When liquid 'X' (an acid like HCl) reacts with zinc granules, bubbles of hydrogen will be formed.

$$2HCl(aq) + Zn(s) \longrightarrow ZnCl_2(s) + H_2(g)$$

(b) When liquid 'X' (an acid like HCl) reacts with sodium carbonate, carbon dioxide gas will be liberated.

$$2HCl(aq) + Na_2CO_3(aq) \longrightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$
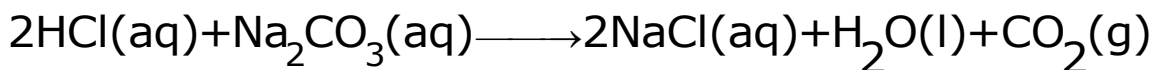
OR

Define water of crystallization. Give the chemical formula for two compounds as examples. How can it be proved that the water of crystallization makes a difference in the state and colour of the compounds? **[5]**

Answer: Water of crystallisation is the number of molecules of water which are loosely bonded to one molecule of salt.

For example:

(1) $BaCl_2.2H_2O$
(2) $CuSO_4.5H_2O$

We can prove that by heating the compound containing water of crystallisation, its colour or state change due to the removal of water of crystallisation.

For example

(1) Copper sulphate crystals containing water of crystallisation are blue but on heating they turn white.

(2) Similarly plaster of Paris is a white powder and on mixing with water it changes to gypsum which forms a hard solid mass.

26. (a) (i) Write two properties of gold which make it the most suitable metal for ornaments.

(ii) Name two metals which are the best conductors of heat.

(iii) Name two metals which melt when you keep them on your palm.

(b) Explain the formation of ionic compound CaO with electron-dot structure. Atomic numbers of calcium and oxygen are 20 and 8 respectively.

[5]

Answer: (a)(i) Gold is inert metal and it has shiny surface. It is also malleable and ductile. Therefore, it is used for making ornaments.

(ii) Copper and aluminium

(iii) Cesium and gallium

(b) The atomic number of calcium and oxygen is 20 and 8 respectively.

The electronic configuration of calcium will be 2, 8, 8, 2 thus, it has 2 electrons in its outermost shell. On the other hand, oxygen (2, 6) has 6 electrons in its outermost shell. By losing two electrons, calcium atom forms a calcium ion (Ca^{2+}) while by gaining 2 electrons; oxygen atom forms an oxide ion (O^{2-}). Calcium reacts with oxygen to form an ionic compound calcium oxide (CaO).

The electron dot representation for the formation of calcium oxide is given below.

Calcium-20   Oxygen-8   Calcium oxide
2,8,8,2   2,6   (CaO)
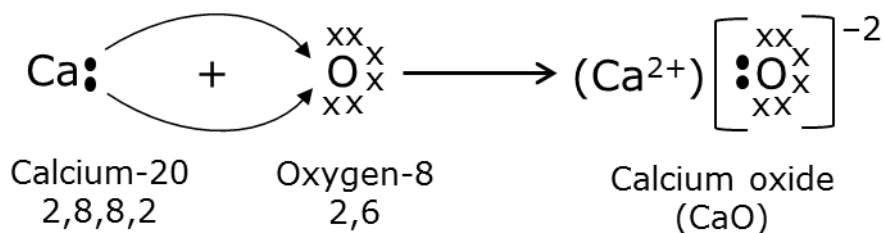
27. (a) Why is nutrition necessary for the human body?

(b) What causes movement of food inside the alimentary canal?

(c) Why is small intestine in herbivores longer than in carnivores?

(d) What will happen if mucus is not secreted by the gastric glands?

[5]

Answer: (a) We obtain nutrition from the food we eat. This nutrition provides us energy for survival, growth and reproduction.

(b) Peristalsis mainly causes the movement of food inside the alimentary canal.

It is defined as a series of wave-like muscular contractions that propels the food inside an alimentary canal.

(c) The small intestine in herbivores is longer than in carnivores because herbivores are plant-eating animals. Plants are made up of cellulose and fibres which are not easily digested.

Therefore, for complete digestion of food, they require a longer digestive tract.

Also, many small bacteria are present in the intestine of herbivores that help in the breakdown of cellulose into glucose. This glucose is used by them as an energy source.

(d) The gastric glands present in the stomach secrete hydrochloric acid, an enzyme – pepsin, and mucus. Hydrochloric acid provides an acidic medium for the enzyme to function. Pepsin digests proteins into smaller peptides. The mucus provides protection to the inner lining of the stomach from the action of the acid.

If mucus is not secreted by the gastric glands, it may erode the inner lining of the stomach resulting in ulcer and acidity.

28. Draw a neat diagram showing fertilisation in a flower and label (a) pollen tube, (b) male germ cell, (c) female germ cell. Explain the process of fertilisation in a flower. What happens to the (i)ovary and (ii) ovule after fertilisation?   [5]

Answer:
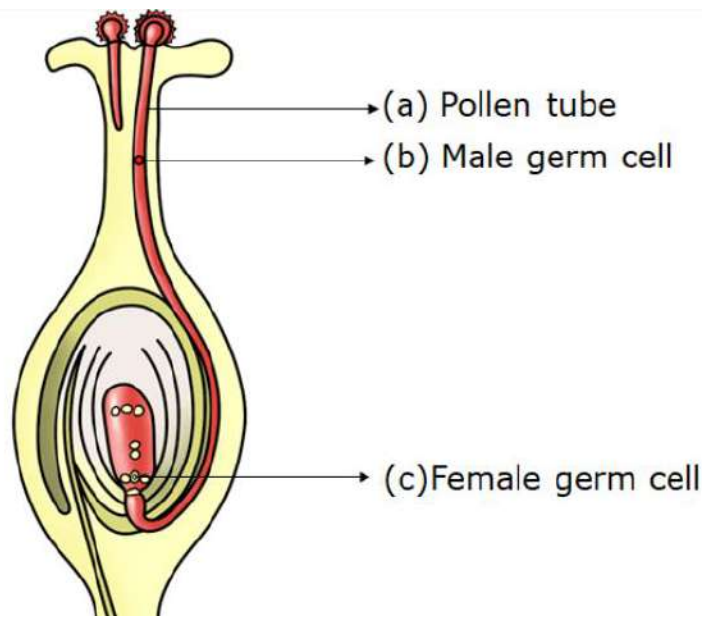
Germination of Pollen on Stigma

When a mature pollen grain reaches the stigma of a flower, it absorbs the sugary secretions of the stigma, swells up and ruptures.

It divides and releases two male gametes, which move down the style to reach the ovary via pollen tube.

On entering the ovule of the ovary through a small opening, called micropyle, one of the male gamete fuses with the female gamete to form a zygote by the process of fertilisation. The other one fuses with the two polar nuclei by the process called triple fusion. Since the fertilisation has occurred twice, it is said that angiospermic plants undergo double fertilisation.

Post fertilisation,

(i) Ovary develops into fruit

(ii) Ovule develops into seed

OR

(a) What is puberty?

(b) Describe in brief the functions of the following parts in the human male reproductive system:

(i) Testes

(ii) Seminal vesicle

(iii) Vas deferens

(iv) Urethra

(c) Why are testes located outside the abdominal cavity?

(d) State how sperms move towards the female germ cell.

[5]

Answer:

(a) The age at which sex hormones begin to produce and reproductive organs of both male and female become functional is termed as puberty. At puberty, both male and female become sexually mature.

(b) (i) Testes: Testes produce male sex cells called sperms and male sex hormone called testosterone.
(ii) Seminal vesicle: Seminal vesicles store sperms and add seminal fluids to the sperms that make their transport easier. The seminal fluids also provide nutrition to the sperms.

(iii) Vas deferens: Vas deferens manages the transportation of the mature sperms to the urethra.

(iv) Urethra : Urethra is a common passage for both urine and sperm. At a time, either of these two fluids are released from the body.

(c) A pair of testes is located outside the abdominal cavity in a pouch-like structure called scrotum to provide accurate temperature for the process of spermatogenesis. The process of spermatogenesis requires 2-3° C less than the body temperature.

(d) Sperms have a long tail that helps them move towards the female germ-cell.

29. Draw a schematic diagram of a circuit consisting of a battery of 3 cells of 2 V each, a combination of three resistors of 10 Ω, 20 Ω and 30 Ω connected in parallel, a plug key and an ammeter, all connected in series. Use this circuit to find the value of the following :

(a) Current through each resistor

(b) Total current in the circuit

(c) Total effective resistance of the circuit [5]

Answer:

Circuit diagram :
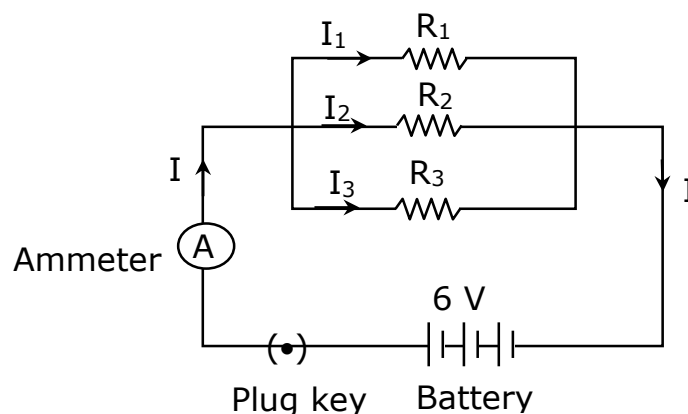
Given:

Voltage in the circuit = 2 V + 2 V +2 V = 6 V

Resistance, R_1 = 10 Ω, R_1 = 20 Ω and R_1 = 30 Ω

Let I be the total current flowing in the circuit and R be the total effective resistance of the circuit.

According to Ohm's law, V = IR

(a) Let electric current flowing through 10 Ω, 20 Ω and 30 Ω resistors be I_1, I_2 and I_3 respectively.

According to Ohm's law, V = IR

$$I_1 = \frac{6\ V}{10\ \Omega} = 0.6\ A$$

$$I_2 = \frac{6\ V}{20\ \Omega} = 0.3\ A$$

$$I_3 = \frac{6\ V}{30\ \Omega} = 0.2\ A$$

(b) Total current flowing in the circuit,

$$I = I_1 + I_2 + I_3$$

∴   I = 0.6 A + 0.3 A + 0.2 A = 1.1 A

(c) Total effective resistance of the circuit, $R = \dfrac{V}{I}$

$$\Rightarrow R = \frac{6\ V}{1.1\ A} = 5.45\ \Omega$$

OR

Two identical resistors, each of resistance 12 Ω, are connected in (i) series, and (ii) parallel, in turn to a battery of 6 V. Calculate the ratio of the power consumed in the combination of resistors in each case. **[5]**
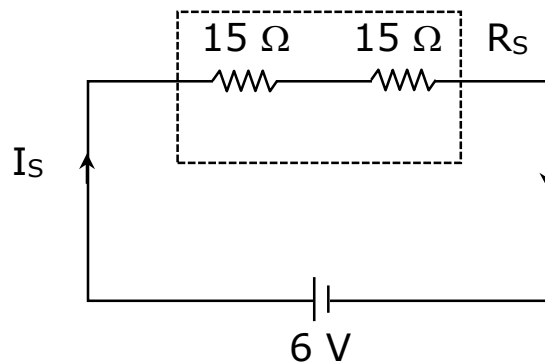
Answer:

Given:

Voltage in the circuit = 6 V

Resistance, $R_1 = R_2 = 15\ \Omega$
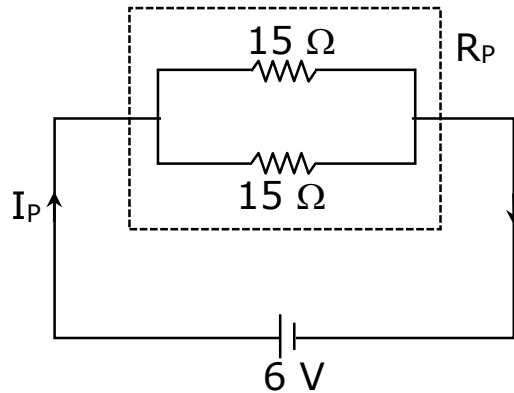
(i) When the two resistances connected in series:

Effective resistance of the circuit, $R_S = R_1 + R_2$

$\quad R_S = 15\ \Omega + 15\ \Omega = 30\ \Omega$

Power consumed by the circuit, $P_s = \dfrac{V^2}{R_s}$

$\Rightarrow P_s = \dfrac{(6\ V)^2}{30\ \Omega} = 1.2\ W$

(ii) When the two resistances connected in parallel:

Effective resistance of the circuit, $\dfrac{1}{R_P} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$

$\Rightarrow \dfrac{1}{R_P} = \dfrac{1}{15\,\Omega} + \dfrac{1}{15\,\Omega} = \dfrac{1}{30\,\Omega}$

Power consumed by the circuit, $P_P = \dfrac{V^2}{R_P}$

$\Rightarrow P_P = \dfrac{(6\text{ V})^2}{30\,\Omega} = 1.2\text{ W}$

$\therefore$ Ratio $= P_S : P_P = 1.2\text{ W} : 1.2\text{ W} = 1 : 1$

So, the ratio of power consumption is 1:1.

30. (a) State Fleming's Left-hand rule.

(b) List three characteristic features of the electric current used in our homes.

(c) What is a fuse ? Why is it called a safety device ?

(d) Why is it necessary to earth metallic electric appliances ? **[5]**

Answer:

(a) Fleming's left-hand rule states that if we stretch the thumb, the forefinger and the middle finger of our left hand in mutually perpendicular directions such that the forefinger gives the direction of current, middle finger points in the direction of magnetic field, then gives the direction of the force or motion of the conductor.

(b) The electric current supplied to our home is alternating in nature. It has following characteristics.

1. It is time varying current.
2. It has frequency of 50 Hz in India.
3. It can be transferred to long distances efficiently.

(c) Fuse is a safety device used in electrical circuit and appliances. It is called safety device because it prevents damage to the appliances and the electrical circuit due to overloading.

(d) The metallic electric appliances are earthed using earth wire as it provides a low resistance path to electric current thus ensuring that any leakage current to the metallic body of the appliance keeps its potential to that of the earth, and the user may not get a severe electric shock.

CBSE Board Paper Solution-2020

Class	: X
Subject	: Mathematics (Basic)
Set	: 1
Code No	: 430/5/1
Time allowed	: 3 Hours
Maximum Marks	: 80 Marks

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i)   This question paper comprises **four** sections – A, B, C and D. This question. Paper carries **40** questions. All questions are compulsory.

(ii)   **Section A:** Question Number **1 to 20** comprises of **20** questions of one mark each.

(iii) **Section B:** Question Number **21 to 26** comprises of 6 questions of two marks each.

(iv)   **Section C:** Question Number **27 to 34** comprises of 8 questions of three marks each.

(v)   **Section D:** Question Number **35 to 40** comprises of 6 questions of four marks each.

(vi)   There is no overall choice in the question Paper. However, an internal choice has been provided in **2** questions of one mark, **2** questions of two marks, **3** questions of three marks and **3** questions of four marks. You have to attempt only one of the choices in such questions.

(vii) In addition to this, separate instructions are given with each section and question, wherever necessary.

(viii) Use of calculators is not permitted.

Section A

Question numbers 1 to 20 carry 1 mark each.

Choose the correct option in question numbers 1 to 10.

1. **If a pair of linear equations is consistent, then the lines represented by them are**
   (A) parallel
   (B) intersecting or coincident
   (C) always coincident
   (D) always intersecting
   Answer:
   Correct Answer: (B) intersecting or coincident
   If a pair of linear equations is consistent, then the lines represented by them are intersecting or coincident.

2. **The distance between the points (3, −2) and (−3, 2) is**
   (A) $\sqrt{52}$ units
   (B) $4\sqrt{10}$ units
   (C) $2\sqrt{10}$ units
   (D) 40 units

Answer:
Correct Answer: (A) √(52) units
  Explanation:

$$\text{Distance} = \sqrt{(3-(-3))^2+(-2-2)^2}$$
$$= \sqrt{(3+3)^2+(-4)^2}$$
$$= \sqrt{36+16}$$
$$= \sqrt{52}$$

3. **8 cot² A – 8 cosec² A equal to**
   (A) 8
   (B) $\dfrac{1}{8}$
   (C) -8
   (D) $-\dfrac{1}{8}$

   Answer:
   Correct Answer: (C) -8
   Explanation:

$$8\cot^2 A - 8\cos ec^2 A$$
$$= 8(\cot^2 A - \cos ec^2 A)$$
$$= 8 \times -1$$
$$= -8$$

4. **The total surface area of a frustum-shaped glass tumbler is ($r_1 > r_2$)**

   (A) $\pi r_1\, l + \pi r_2\, l$

(B) $\pi l(r_1 + r_2) + \pi r_2^2$

(C) $\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$

(D) $\sqrt{h^2 + (r_1 - r_2)^2}$

Answer:

Correct Answer: (C) $\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$

Explanation:

The total surface area of a frustum-shaped glass tumbler is $\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$ where radii $r_1 > r_2$.

5. **120 can be expressed as a product of its prime factors as**
   (A) $5 \times 8 \times 3$
   (B) 15×2^3
   (C) $10 \times 2^2 \times 3$
   (D) $5 \times 2^3 \times 3$

Answer:

Correct Answer: (D) $5 \times 2^3 \times 3$

Explanation:

$120 = 20 \times 6$

$\quad = 5 \times 4 \times 2 \times 3$

$\quad = 5 \times 2^3 \times 3$

6. **The discriminant of the quadratic equation $4x^2 - 6x + 3 = 0$ is**

(A) 12

(B) 84

(C) $2\sqrt{3}$

(D) −12

Answer:

Correct Answer: (D) −12

Explanation:

The given equation is:

$4x^2 - 6x + 3 = 0$

Discriminant $= b^2 - 4ac$

Here, b = −6, a = 4, and c = 3

So, Discriminant $= (-6)^2 - 4 \times 4 \times 3$

$\qquad\qquad\qquad = 36 - 48 = -12$

7. **If (3, − 6) is the mid-point of the line segment joining (0, 0) and (x, y), then the point (x, y) is**

(A) (−3, 6)

(B) (6, − 6)

(C) (6, −12)

(D) $\left(\dfrac{3}{2}, -3 \right)$

Answer:

Correct Answer: (C) (6, −12)

Explanation:

(3, −6) is the mid-point of the line segment joining

(0, 0) and (x, y).
So, $(0+x)/2 = 3$ or, $x = 6$
And $(0+y)/2 = -6$ or, $y = -12$

8) **In the circle given in Figure-1, the number of tangents parallel to tangent PQ is**
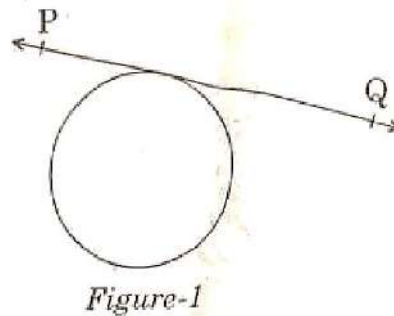
Figure-1

(A) 0

(B) many

(C) 2

(D) 1

Answer:
Correct Answer: (D) 1
In the given figure, number of tangents parallel to tangent PQ is 1.

9) **For the following frequency distribution:**

Class:	0–5	5–10	10–15	15–20	20–25
	8	10	19	25	8

The upper limit of median class is

(A) 15

(B) 10

(C) 20

   (D) 25

Answer:
Correct Answer: (A) 15

Explanation:

Class	Frequency	Cumulative frequency
0-5	8	8
5-10	10	18
10-15	19	37
15-20	25	62
20-25	8	70
Sum:	70	

Sum of frequencies (n)= 70

Middle observation = ((n/2)+1) th observation

$$= (70/2 +1) \text{ th observation}$$

$$= 36^{th} \text{ observation}$$

36th observation lies in class interval 10-15. So, median class is 10-15 and its upper limit is 15.

10) The probability of an impossible event is

(A) 1

(B) $\dfrac{1}{2}$

(C) not defined

(D) 0

Answer:
Correct Answer: (D) 0
Explanation:
The probability of an impossible event is 0.

Fill in the blanks in question numbers 11 to 15.

11) A line intersecting a circle in two points is called a_____.
Answer:
secant

12) If 2 is a zero of the polynomial ax² − 2x, then the value of 'a' is _____.
Answer:
1

$a(2)^2 - 2 \times 2 = 0$

$\Rightarrow \quad 4a - 4 = 0$

$\Rightarrow \qquad a = 1$

13) All squares are_____. (congruent/similar)
Answer:
similar

14) If the radii of two spheres are in the ratio 2:3, then the ratio of their respective volumes is_____.

Answer:
8:27

$r_1 : r_2 = 2 : 3$

$$\frac{V_1}{V_2} = \frac{\frac{4}{3}\pi r_1^{\,3}}{\frac{4}{3}\pi r_2^{\,3}} = \frac{r_1^{\,3}}{r_2^{\,3}}$$

$$\frac{V_1}{V_2} = \frac{8}{27}$$

15) If ar (ΔPQR) is zero, then the points P, Q and R are_____.

Answer:
collinear

Answer the following question numbers 16 to 20:

16) In Figure-2, the angle of elevation of the top of a tower AC from a point B on the ground is 60°. If the height of the tower is 20 m, find the distance of the point from the foot of the tower.
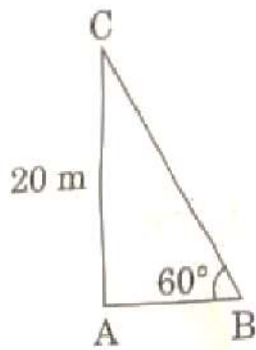
Figure-2

Answer:

$$\tan 60^\circ = \frac{20}{AB}$$

$$\sqrt{3} = \frac{20}{AB}$$

$$AB = \frac{20}{\sqrt{3}}$$

So, the required distance is $\dfrac{20}{\sqrt{3}}$ m.

17) Evaluate:

tan 40° × tan 50°

OR

If cos A = sin 42°, then find the value of A.

Answer:

$$\tan 40° \times \tan 50°$$
$$= \tan(90° - 50°) \times \tan 50°$$
$$= \cot 50° \times \tan 50°$$
$$= 1 \qquad (\because \tan\theta \cot\theta = 1)$$

OR

$$\cos A = \sin 42°$$
$$\Rightarrow \cos A = \sin(90° - 48°)$$
$$\Rightarrow \cos A = \cos 48°$$
$$\Rightarrow \quad A = 48°$$

18) A coin is tossed twice. Find the probability of getting head both the times.

Answer:
All possible outcomes are HH, HT, TT, TH.

$$\text{Probability of an event} = \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}}$$

Probability of getting head both the times$= \dfrac{1}{4}$

19) Find the height of a cone of radius 5 cm and slant height 13 cm.

Answer:

Height of the cone $= \sqrt{13^2 - 5^2}$

$$= \sqrt{169 - 25}$$
$$= \sqrt{144}$$
$$= 12$$

Therefore, the height of the cone is 12m.

20) Find the value of x so that -6, x, 8 are in A.P.

OR

Find the 11th term of the A.P. $-27, -22, -17, -12,$ ....

Answer:

$-6, x, 8$ are in A.P.

$\Rightarrow 2x = -6 + 8$

$\Rightarrow 2x = 2$

$\Rightarrow x = 1$

OR

$-27, -22, -17, -12, ...$

$a_n = a + (n-1)d$

$a_{11} = -27 + (11-1) \times 5$

$= -27 + 50$

$= 23$

Section - B

Question numbers 21 to 26 carry 2 marks each.

21) Find the roots of the quadratic equation.

$$3x^2 - 4\sqrt{3}\,x + 4 = 0$$

Answer:

$$3x^2 - 4\sqrt{3}x + 4 = 3x^2 - 2\sqrt{3}x - 2\sqrt{3}x + 4$$
$$= \sqrt{3}x\left(\sqrt{3}x - 2\right) - 2\left(\sqrt{3}x - 2\right)$$
$$= \left(\sqrt{3}x - 2\right)\left(\sqrt{3}x - 2\right)$$

So, the roots of the equation are the values of x for which

$$\left(\sqrt{3}x - 2\right)\left(\sqrt{3}x - 2\right) = 0$$

Now, $\sqrt{3}x - 2 = 0$ for x $= \dfrac{2}{\sqrt{3}}$

So, this root is repeated twice, one for each repeated factor $\sqrt{3}x - 2$.

Therefore, the roots of $3x^2 - 4\sqrt{3}x + 4$ are $\dfrac{2}{\sqrt{3}}, \dfrac{2}{\sqrt{3}}$.

22) Check whether 6^n can end with the digit '0' (zero) for any natural number n.

OR

Find the LCM of 150 and 200.

Answer:

If the number 6^n, for any n, were to end with the digit zero, then it would be divisible by 5.

That is, the prime factorisation of 6^n would contain the prime 5. This is not possible

$\because 6^n = (2 \times 3)^n$

So, the prime numbers in the factorisation of 6^n are 2 and 3.

So, the uniqueness of the Fundamental Theorem of Arithmetic guarantees that there are no other primes in the factorisation of 6^n.

So, there is no natural number n for which 6^n ends with the digit zero.

OR

We have,

$$150 = 5^2 \times 3 \times 2$$

and, $200 = 5^2 \times 2^3$

Here, $2^3, 3^1$ and 5^2 are the greatest powers of the prime factors 2, 3 and 5 respectively involved in the two numbers.

So, $\text{LCM}(150, 200) = 2^3 \times 3^1 \times 5^2 = 600$

23) **If $\tan(A + B) = \sqrt{3}$ and $\tan(A - B) = \dfrac{1}{\sqrt{3}}, 0 < A + B$**

$\leq 90°$, A > B, then find the values of A and B.

Answer:

We have

$$\tan (A + B) = \sqrt{3}$$

or $\tan (A + B) = \tan 60°$

or $A + B = 60°$ ...(1)

Again, we have

$$\tan (A - B) = \frac{1}{\sqrt{3}}$$

or $\tan (A - B) = \tan 30°$

or $A - B = 30°$ ...(2)

On adding equations (1) and (2), we get

$$2A = 90°$$

or $A = 45°$

On putting this value of A in equation (1), we get

$$B = 15°$$

24. In Figure-3, ΔABC and ΔXYZ are shown. If AB = 3 cm, BC = 6 cm, AC = 2 $\sqrt{3}$ cm, ∠ A = 80⁰, ∠B 60⁰, XY = 4 $\sqrt{3}$ cm, YZ = 12 cm and XZ = 6 cm, then find the value of ∠Y.
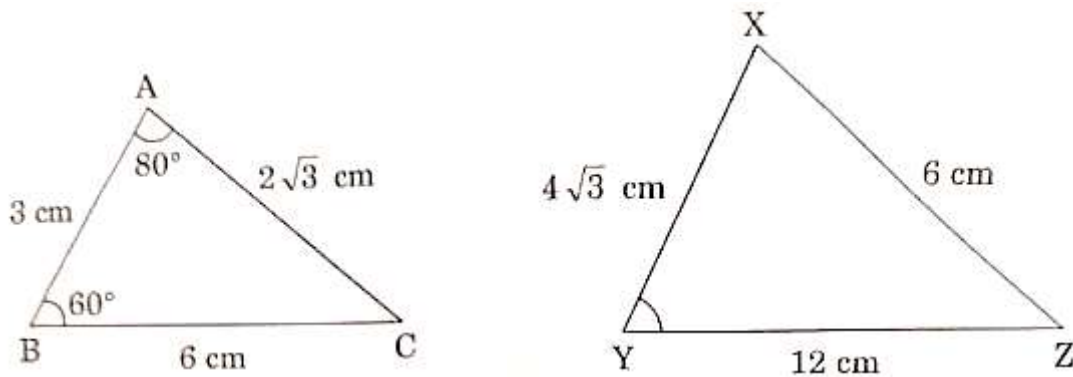
Figure-3

Answer:
In ΔABC and ΔXZY,

$$\frac{BC}{ZY} = \frac{6}{12}$$

$$= \frac{1}{2}$$

$$\frac{AC}{XY} = \frac{2\sqrt{3}}{4\sqrt{3}}$$

$$= \frac{1}{2}$$

$$\frac{AB}{XZ} = \frac{3}{6}$$

$$= \frac{1}{2}$$

Ratios of the corresponding sides of the given pair of triangles are equal.

i.e., $\dfrac{BC}{YZ} = \dfrac{AC}{XY} = \dfrac{AB}{XZ} = \dfrac{1}{2}$

Therefore, by SSS similarity critarion, $\triangle$ABC ~ $\triangle$XZY.
The corresponding angles are equal in $\triangle$ABC
and $\triangle$XZY. i.e.,
$\angle$A = $\angle$X = 80°,
$\angle$B = $\angle$Z = 60°
and
$\angle$C = $\angle$Y
In $\triangle$ABC,
$\qquad$ $\angle$A + $\angle$B + $\angle$C = 180°
$\Rightarrow$ 80° + 60° + $\angle$C = 180°
$\Rightarrow$ $\qquad\qquad$ $\angle$C = 180° − 140°
$\Rightarrow$ $\qquad\qquad$ $\angle$C = 40°
$\Rightarrow$ $\qquad\qquad$ $\angle$Y = 40°

25. 14 defective bulbs are accidentally mixed with 98 good ones. It is not possible to just look at the bulb and tell whether it is defective or not. One bulb is taken out at random from this lot. Determine the probability that the bulb taken out is a good one.

Answer:

Number of defective bulbs $= 14$

Number of good bulbs $= 98$

Total number of outcomes $= 98 + 14 = 112$

Probability of getting a good bulbs

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{98}{112}$$

$$= \frac{7}{8}$$

26. Find the mean for the following distribution:

Classes	5 – 15	15 – 25	25 – 35	35 – 45
Frequency	2	4	3	1

OR

The following distribution shows the transport expenditure of 100 employees:

Expenditure (in ₹) :	200-400	400-600	600-800	800-1000	1000-1200
Number of employees :	21	25	19	23	12

Find the mode of the distribution.

Answer:

Classes	5-15	15-25	25-35	35-45
Frequency	2	4	3	1

Here, we observe that class marks and frequencies are small quantities.

So, we use direct method to compute the mean and proceed as below.

Classes	Frequency (f_i)	x_i	$f_i x_i$
5 – 15	2	10	20
15 – 25	4	20	80
25 – 35	3	30	90
35 – 45	1	40	40
Total	10		230

Mean, $\bar{x} = \dfrac{\sum f_i x_i}{\sum f_i}$

$= \dfrac{230}{10}$

$= 23$

Therefore, mean for the following distribution is 23.

OR

Expenditure	200-400	400-600	600-800	800-1000	1000-1200
Number of employees	21	25	19	23	12

From the given data, we have

$l = 400,\ f_1 = 25,\ f_0 = 21,\ f_2 = 19,\ h = 200$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 400 + \left(\frac{25 - 21}{2 \times 25 - 21 - 19} \right) \times 200$$
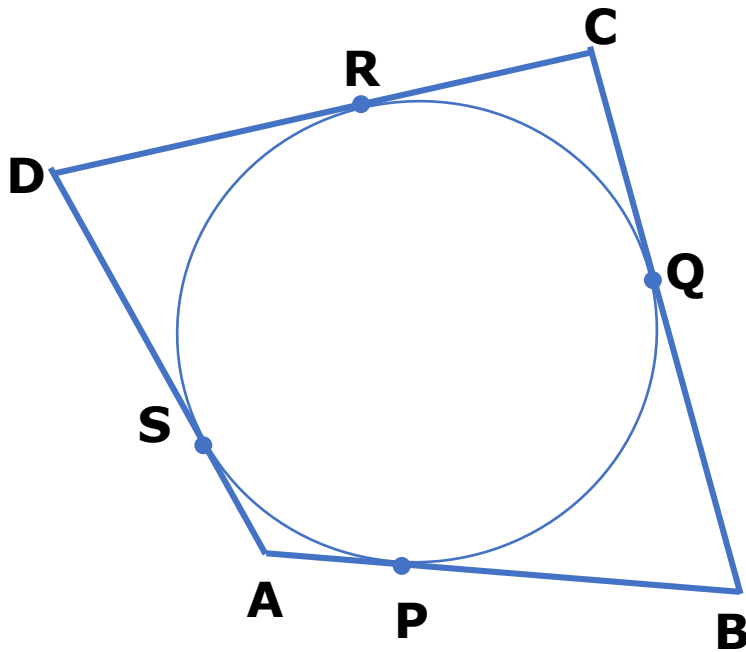
$$= 480$$

$\therefore$ Mode of the given data is 480.

SECTION C

Question number 27 to 34 carry 3 marks each.

27. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that

AB + CD = AD + BC.

Answer:

In the given figure, quadrilatetral ABCD is circumscribing the given circle and its sides are touching the circle at P, Q, R and S.

We have to prove that

$AB + CD = AD + BC$

We know that lengths of tangents drawn from a point to a circle are equal.

Therefore, from figure, we have

$DR = DS,\ CR = CQ,\ AS = AP,\ BP = BQ$

Now,

$$\begin{aligned} \text{L.H.S.} = AB + CD &= (AP + BP) + (CR + DR) \\ &= (AS + BQ) + (CQ + DS) \\ &= AS + DS + BQ + CQ \\ &= AD + BC \\ &= \text{R.H.S.} \end{aligned}$$

28. The difference between two numbers is 26 and the larger number exceeds thrice of the smaller number by 4. Find the numbers.

<div align="center">

OR

</div>

Solve for x and y:

$$\frac{2}{x} + \frac{3}{y} = 13 \ \text{ and } \ \frac{5}{x} - \frac{4}{y} = -2$$

Answer:

Let the larger number be y and the smaller number be x.

According to question,

y − x = 26   …(1)

and y = 3x + 4   …(2)

Substituting the value of y from equation (2) in equation (1), we get

3x + 4 − x = 26

or   2x = 26 − 4

or   2x = 22

or   x = 11

Putting this value of x in equation (1), we get

y − 11 = 26

or   y = 26 + 11 = 37

Hence, the numbers are 11 and 37.

OR

$$\frac{2}{x} + \frac{3}{y} = 13 \text{ and } \frac{5}{x} - \frac{4}{y} = -2$$

Let $\frac{1}{x} = p$ and $\frac{1}{y} = q$

then given equations can be written as:

$2p + 3q = 13$

$2p + 3q - 13 = 0 \quad ...(1)$

and

$5p - 4q = -2$

$5p - 4q + 2 = 0 \quad ...(2)$

Using cross-multiplication method, we get

$$\frac{p}{6 - 52} = \frac{q}{-65 - 4} = \frac{1}{-8 - 15}$$

$$\Rightarrow \frac{p}{-46} = \frac{q}{-69} = \frac{1}{-23}$$

$$\Rightarrow \frac{p}{-46} = \frac{1}{-23} \text{ and } \frac{q}{-69} = \frac{1}{-23}$$

$$\Rightarrow p = \frac{-46}{-23} \text{ and } q = \frac{-69}{-23}$$

$$\Rightarrow p = 2 \quad \text{and } q = 3$$

$$\Rightarrow \frac{1}{x} = 2 \quad \text{and } \frac{1}{y} = 3$$

$$\Rightarrow x = \frac{1}{2} \quad \text{and } y = \frac{1}{3}$$

29. Prove that $\sqrt{3}$ is an irrational number.

Answer:

Let us assume that $\sqrt{3}$ is rational.

So we can find integers r and $s\,(\neq 0)$ such that

$$\sqrt{3} = \frac{r}{s}.$$

Suppose r and s have a common factor other than 1.

Then we divide r and s by the common factor and get

$$\sqrt{3} = \frac{a}{b}$$

where a and b are coprime.

So, $\sqrt{3}\,b = a$

Squaring on both sides, we get

$$3b^2 = a^2$$

Therefore,

a^2 is divisible by 3, and so a is also divisible by 3.

So, we can write $a = 3c$ for some integer c.

Now,
$$3b^2 = a^2$$
$$\Rightarrow 3b^2 = 9c^2$$
$$\Rightarrow b^2 = 3c^2.$$
This means that b^2 is divisible by 3, and so b is also divisible by 3.
Therefore,
a and b have at least 3 as a common factor.
But this contradicts the fact that a and b are coprime.
So, our assumption that $\sqrt{3}$ is a rational is wrong.
Hence, $\sqrt{3}$ is an irrational number.

30. Krishna has an apple orchard which has a 10 m ×10 m sized kitchen garden attached to it. She divides it into a 10 ×10 grid and puts soil and manure into it. She grows a lemon plant at A, a coriander plant at B, an onion plant at C and a tomato plant at D. Her husband Ram praised her kitchen garden and points out that on joining A, B, C and D they may form a parallelogram. Look at the below figure carefully and answer the following questions:
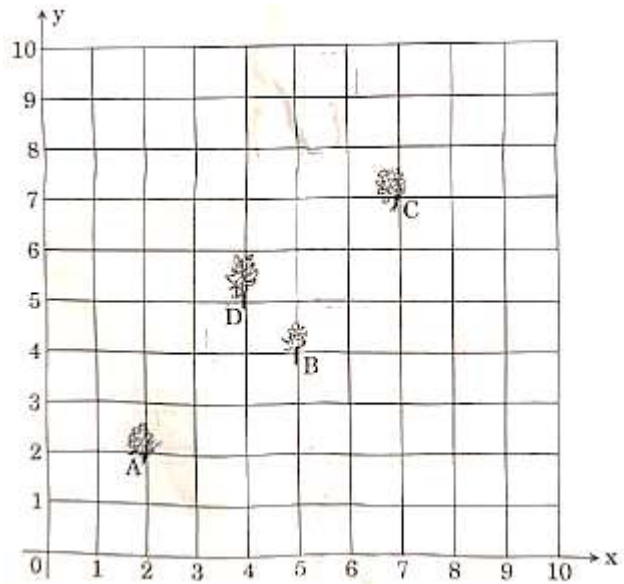
(i) Write the coordinates of the points A, B, C and D, using the 10 ×10 grid as coordinate axes.

(ii) Find whether ABCD is a parallelogram or not.

Answer:

(i)

From the given figure, the coordinates of points A, B, C and D can be written as below:

A(2, 2), B(5, 4), C(7, 7) and D(4, 5).

(ii)

We know that a quadrilateral is a parallelogram if its opposite sides are equal.

Now, using distance formula, we will find the length of each side of the quadrilatral ABCD.

$$AB = \sqrt{(5-2)^2 + (4-2)^2} = \sqrt{9+4} = \sqrt{13},$$

$$BC = \sqrt{(7-5)^2 + (7-4)^2} = \sqrt{4+9} = \sqrt{13},$$

$$CD = \sqrt{(4-7)^2 + (5-7)^2} = \sqrt{9+4} = \sqrt{13},$$

$$DA = \sqrt{(2-4)^2 + (2-5)^2} = \sqrt{4+9} = \sqrt{13}$$

We see that sides AB, BC, CD and DA are equal in lengths. Therefore, quadrilateral ABCD is a parallelogram.

31. **If the sum of the first 14 terms of an A.P. is 1050 and its first term is 10, then find the 21st term of the A.P.**

Answer:

Here, $S_{14} = 1050$, $a = 10$

We have to find a_{21}.

We know that sum of first n terms of an AP is given by

$$S_n = \frac{n}{2}\left[2a + \left(n-1\right)d\right]$$

So, $S_{14} = \frac{14}{2}\left(2 \times 10 + 13 \times d\right)$

$\quad 1050 = 7(20 + 13d)$

or $\quad d = 10$

We know that

$\quad a_n = a + (n-1)d$

So, $a_{21} = 10 + (21 - 1)10$

$\qquad = 10 + 20 \times 10$

$\qquad = 210$

32. Construct a triangle with its sides 4 cm, 5 cm and 6 cm. Then construct a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

OR

Draw a circle of radius 2.5 cm. Take a point P at a distance of 8 cm from its centre. Construct a pair of tangents from the point P to the circle.

Answer:
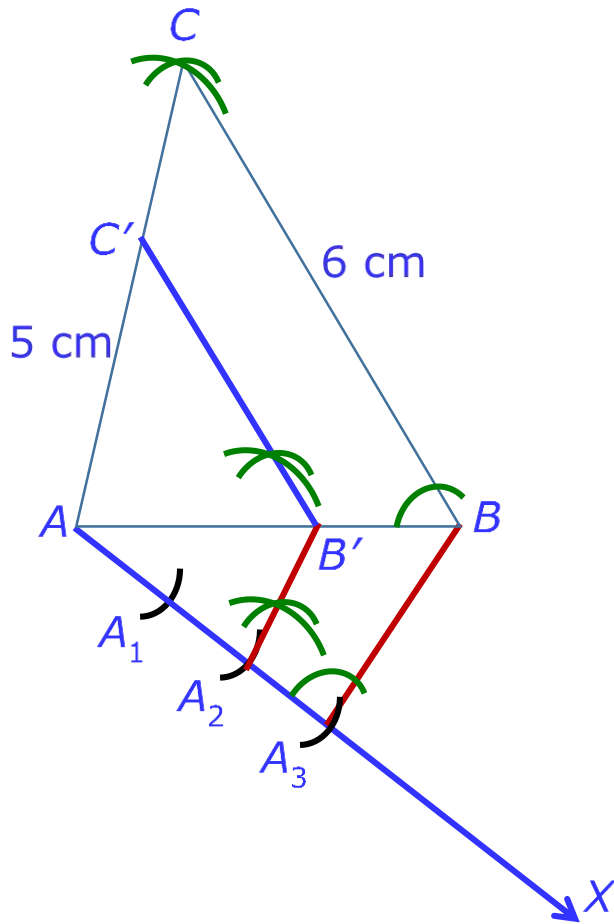
Step 1: Draw a line segment AB $=$ 4 cm. Taking point A as centre, draw an arc of 5 cm radius. Again, taking point B as centre, draw an arc of 6 cm. These arcs intersect each other at point C. So, we have AC $=$ 5cm and BC $=$ 6 cm. $\triangle$ABC is the required triangle.

Step 2: Draw a ray AX making an acute angle with line AB on the opposite side of vertex C.

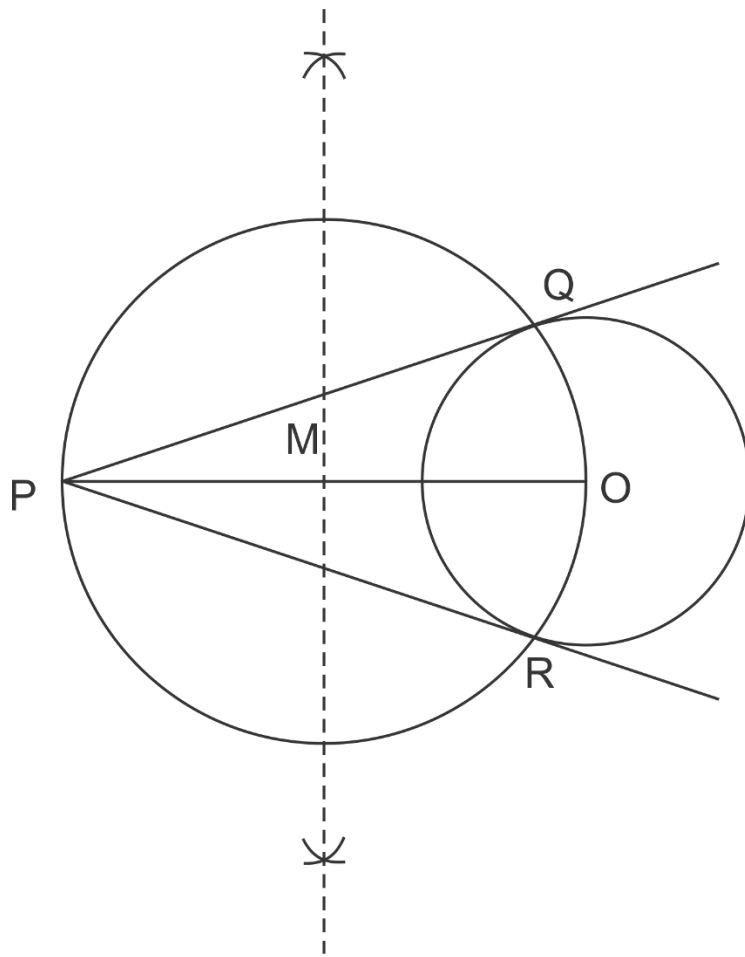Step 3: Locate 3 points A_1, A_2, A_3 on AX such that $AA_1 = A_1A_2 = A_2A_3$.

Step 4: Join the points B and A_3.

Step 5: Through the point A_2, draw a line parallel to BA_3 intersecting AB at point B$'$.

Step 6: Draw a line through B$'$ parallel to the line BC to intersect AC at C$'$.

The required triangle is $\triangle$AB$'$C$'$.

OR

Steps of Construction :

Step 1: Draw a circle of radius 2.5 cm with centre at point O.
Locate a point P, at a distance of 8 cm from O, and join O and P.

Step 2: Bisect OP. Let M be the mid-point of OP.

Step 3: Draw a circle with centre at M and MO as radius. Q and R are points of intersections of this circle with the circle having centre at O.

Step 4: Join PQ and PR.
PQ and PR are the required tangents.

33. Prove that:

$$\text{cosec } A - \sin A \quad \sec A - \cos A = \frac{1}{\tan A + \cot A}$$

Answer:

LHS $= (\text{cosec } A - \sin A)(\sec A - \cos A)$

$$= \left(\frac{1}{\sin A} - \sin A\right)\left(\frac{1}{\cos A} - \cos A\right)$$

$$= \left(\frac{1 - \sin^2 A}{\sin A}\right)\left(\frac{1 - \cos^2 A}{\cos A}\right)$$

$$= \frac{\cos^2 A}{\sin A} \times \frac{\sin^2 A}{\cos A}$$

$$= \frac{\sin A \cos A}{1}$$

$$= \frac{\sin A \cos A}{\sin^2 A + \cos^2 A}$$

$$= \frac{1}{\dfrac{\sin^2 A + \cos^2 A}{\sin A \cos A}}$$

$$= \frac{1}{\dfrac{\sin A}{\cos A} + \dfrac{\cos A}{\sin A}}$$

$$= \frac{1}{\tan A + \cot A}$$

$= $ RHS

34. In Figure – 4, AB and CD are two diameters of a circle (with centre O) perpendicular to each other and OD is the diameter of the smaller

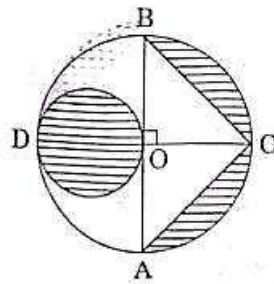circle. If OA = 7 cm, then find the area of the shaded region.

Figure-4

OR

In Figure – 5 ABCD is a square with side 7 cm. A circle is drawn circumscribing the square. Find the area of the shaded region.
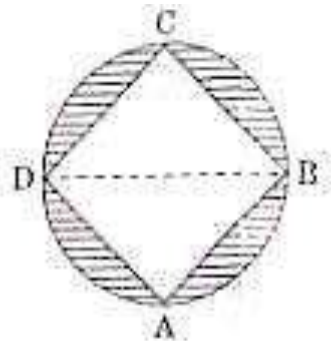

Figure-5

Answer:

For bigger circle, $OA = 7\,cm$

Diameter of the smaller circle $= 7\,cm$

Radius of the smaller circle $= \dfrac{7}{2}\,cm$

Area of the smaller circle $= \dfrac{22}{7} \times \dfrac{7}{2} \times \dfrac{7}{2}$

$$= \dfrac{77}{2}\ cm^2$$

Area of shaded region

$= $ Area of the smaller circle $+\ 2 \times$ Area of segment OCB

$= \dfrac{77}{2}\ cm^2 + 2 \times \left(\text{Area of quadrant} - \text{Area}\,\triangle ABC\right)$

$= \dfrac{77}{2}\ cm^2 + 2 \times \left(\dfrac{1}{4} \times \dfrac{22}{7} \times 7^2 - \dfrac{1}{2} \times 7 \times 7\right) cm^2$

$= \dfrac{77}{2}\ cm^2 + 49\left(\dfrac{11}{7} - 1\right) cm^2$

$= \dfrac{77}{2}\ cm^2 + 49\left(\dfrac{4}{7}\right) cm^2$

$= \dfrac{77}{2}\ cm^2 + 28\ cm^2$

$= \dfrac{77 + 56}{2}\ cm^2$

$= \dfrac{133}{2}\ cm^2$

$= 66.5\ cm^2$

OR

ABCD is a square with side 7 cm. Then,

Length of the diagonal of square $= 7\sqrt{2}$ cm

Diameter of circle = Diagonal of square

$\Rightarrow \qquad\qquad\qquad\qquad BD = 7\sqrt{2}$ cm

Radius of circle $= \dfrac{BD}{2}$

$= \dfrac{7\sqrt{2}}{2}$ cm

Area of shaded region = Area of circle − Area of the sqaure

$= \dfrac{22}{7} \times \dfrac{7\sqrt{2}}{2} \times \dfrac{7\sqrt{2}}{2} - 7 \times 7$

$= 77 - 49$

$= 28$ cm^2

Therefore, the area of the saded region is 28 cm^2.

Section D

Question numbers 35 to 40 carry 4 marks each.

35. Find other zeroes of the polynomial

$$p\ x\ = 3x^4 - 4x^3 - 10x^2 + 8x + 8,$$

if two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

OR

Divide the polynomial g$\left(x\right)$ = $x^3 - 3x^2 + x + 2$ by the polynomial $x^2 - 2x + 1$ and verify the division algorithm.

Answer:

The given polynomial is $p(x) = 3x^4 - 4x^3 - 10x^2 + 8x + 8$

The two zeroes of p(x) are $\sqrt{2}$ and $-\sqrt{2}$.

Therefore, $\left(x - \sqrt{2}\right)$ and $\left(x + \sqrt{2}\right)$ are factors of p(x).

Also, $\left(x - \sqrt{2}\right)\left(x + \sqrt{2}\right) = x^2 - 2$

and so $x^2 - 2$ is a factor of p(x).

Now,

$$
\begin{array}{r}
3x^2 - 4x - 4 \\
x^2 - 2 \overline{\smash{\big)}\ 3x^4 - 4x^3 - 10x^2 + 8x + 8} \\
\underline{3x^4 \qquad\quad - 6x^2} \\
- \qquad\qquad + \\
\hline
- 4x^3 - 4x^2 + 8x + 8 \\
\underline{- 4x^3 \qquad\qquad + 8x} \\
+ \qquad\qquad - \\
\hline
- 4x^2 \qquad + 8 \\
\underline{- 4x^2 \qquad + 8} \\
+ \qquad - \\
\hline
0
\end{array}
$$

$$3x^4 - 4x^3 - 10x^2 + 8x + 8 = (x^2 - 2)(3x^2 - 4x - 4)$$
$$= (x^2 - 2)(3x^2 - 6x + 2x - 4)$$
$$= (x^2 - 2)(3x + 2)(x - 2)$$

Equating $(x^2 - 2)(3x + 2)(x - 2)$ to zero, we get the zeroes of the given polynomial.

Hence, the zeroes of the given polynomial are :

$\sqrt{2}, -\sqrt{2}, -\dfrac{2}{3}$ and 2.

OR

The given polynomial is $g(x) = x^3 - 3x^2 + x + 2$.

Here, divisor is $x^2 - 2x + 1$.

Divide $g(x) = x^3 - 3x^2 + x + 2$ by $x^2 - 2x + 1$ and find the remainder.

$$\begin{array}{r} x-1 \\ x^2-2x+1 \overline{\smash{\big)}\ x^3-3x^2+x+2} \\ x^3-2x^2+x \\ -\quad+\quad- \\ \hline -x^2\qquad+2 \\ -x^2+2x-1 \\ +\quad-\quad+ \\ \hline -2x+3 \end{array}$$

So, Quotient $=x-1$ and Remainder $=-2x+3$.

The division alogorithm states that

Dividend $=$ Divisor $\times$ Qoutient + Remainder

RHS $=$ Divisor $\times$ Qoutient + Remainder

$$= \left(x^2-2x+1\right)\left(x-1\right)-2x+3$$

$$= x^3-2x^2+x-x^2+2x-1-2x+3$$

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

$$= \text{LHS}$$

Thus, the division alogorithm is verified.

36. From the top of a 75 m high lighthouse from the seal level, the angles of depression of two ships are 30°and 45° if the ships are on the opposite sides of the lighthouse, then find the distance between the two ships.

Answer:

Let AB be a lighthouse and ships be at points C and D. It is given that AB = 75 m. We have to find the distance CD.
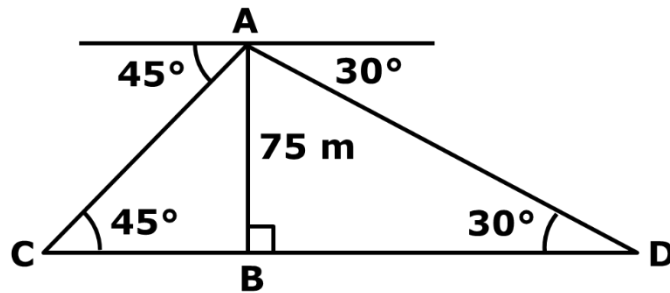
In △ABC, we have

$$\tan 45° = \frac{AB}{BC}$$

or $\quad 1 = \dfrac{AB}{BC}$

or $\quad BC = AB = 75 \qquad ...(1)$

Now,

In △ABD, we have

$$\tan 30° = \frac{AB}{BD}$$

or $\quad \dfrac{1}{\sqrt{3}} = \dfrac{75}{BD}$

or $\quad BD = 75\sqrt{3} \qquad\qquad ...(2)$

From (1) and (2), we get

$$CD = BC + BD = 75\ + 75\sqrt{3} = 75\left(1 + \sqrt{3}\right)$$

Therefore, the distance between the two ships is $75\left(1 + \sqrt{3}\right)$ m.

37. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, prove that the other two sides are divided in the same ratio.
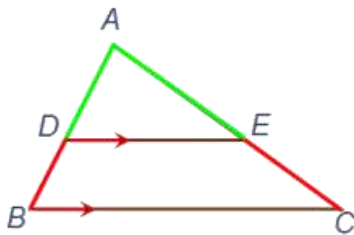
OR

In Figure-6, in an equilateral triangle ABC, AD⊥ BC, BE ⊥ AC and CF ⊥ AB. Prove that $4(AD^2+BE^2+CF^2) = 9\ AB^2$.
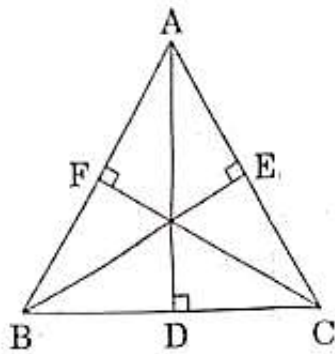
Figure-6

Answer:
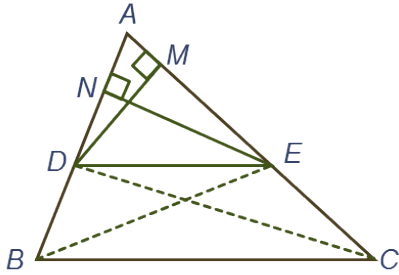
<u>Given :</u> In ∆ABC, DE ∥ BC.

<u>To Prove :</u> $\dfrac{AD}{DB} = \dfrac{AE}{EC}$.

<u>Construction :</u>

 i Join BE and CD.

 ii Draw DM ⊥ AC and EN ⊥ AB.

<u>Proof :</u>

$$\text{area}(\Delta ADE) = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times AD \times EN$$

and

$$\text{area}(\Delta BDE) = \frac{1}{2} \times BD \times EN$$

Therefore,

$$\frac{\text{area } \Delta ADE}{\text{area } \Delta BDE} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times BD \times EN} = \frac{AD}{BD} \quad \dots 1$$

Similarly,

$$\frac{\text{area } \Delta ADE}{\text{area } \Delta DEC} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \quad \dots 2$$

But area ΔBDE = area ΔDEC $\quad \dots 3$

$\left(\begin{array}{l}\text{Triangles on the same base and between the same} \\ \text{parallels are equal in area.}\end{array}\right)$

Therefore, from 1, 2 and 3 we get

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

Hence, proved.

OR

ABC is an equilateral triangle.

Therefore, AB = BC = AC

Now,

$$BD = DC = \frac{BC}{2} = \frac{AB}{2} \quad \left(\begin{array}{l}\text{D is the midpoint of BC}\\\text{and AB = BC}\end{array}\right)$$

Using Pythagoras theorem in $\triangle ADC$, we get

$$AC^2 = AD^2 + DC^2$$

$$AB^2 = AD^2 + \left(\frac{AB}{2}\right)^2 \quad \left(AC = AB \text{ and } DC = \frac{AB}{2}\right)$$

$$AB^2 = AD^2 + \frac{AB^2}{4}$$

$$AB^2 - \frac{AB^2}{4} = AD^2$$

$$\frac{3AB^2}{4} = AD^2$$

$$3AB^2 = 4AD^2 \qquad \dots ①$$

Similarly, using Pythagoras theorem in $\triangle AEB$, we get

$$3AB^2 = 4BE^2 \qquad \dots ②$$

Again, using Pythagoras theorem in $\triangle AFC$, we get

$$3AB^2 = 4CF^2 \qquad \dots ③$$

On adding equations ①, ② and ③, we get

$$3AB^2 + 3AB^2 + 3AB^2 = 4AD^2 + 4BE^2 + 4CF^2$$

or, $9AB^2 = 4\left(AD^2 + BE^2 + CF^2\right)$

or, $4\left(AD^2 + BE^2 + CF^2\right) = 9AB^2$

Hence, proved

38. A container open at the top and made up of a metal sheet, is in the form of a frustum of a cone of height 14 cm with radii of its lower and upper circular ends as 8 cm and 20 cm. respectively. Find the capacity of the container.

Answer:

Height of the frustum $= h = 14$ cm

Radius of upper end of the frustum $= r_1 = 20$ cm

Radius of lower end of the frustum $= r_2 = 8$ cm

Capacity of container $=$ Volume of the frustum

$$= \frac{1}{3}\pi h\left(r^2_1 + r_2^2 + r_1 r_2\right)$$

$$= \frac{14}{3} \times \frac{22}{7}\left(20^2 + 8^2 + 20 \times 8\right)$$

$$= \frac{44}{3}\left(400 + 64 + 160\right)$$

$$= \frac{44}{3} \times 624$$

$$= 9152 \text{ cm}^3$$

39. Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

OR

A rectangular park is to be designed whose breadth is 3 m less than its length. Its area is to be 4 square metres more than the area of a park that has already been made in the shape of an isosceles triangle   with its base as the breadth of the rectangular park and of altitude 12 m. Find the length and breadth of the park.

Answer:

Let A and B be the time taken by the smaller and the larger taps respectively to fill the tank.

Since both the taps together can fill the tank in

$9\dfrac{3}{8}$ hours $= \dfrac{75}{8}$ hours.

So, $\dfrac{1}{A} + \dfrac{1}{B} = \dfrac{1}{\dfrac{75}{8}}$

Or, $\dfrac{1}{A} + \dfrac{1}{B} = \dfrac{8}{75}$ ... 1

Tap with larger diameter takes 10 hours less than smaller one to fill the tank.

So, $A - 10 = B$

Or, $\dfrac{1}{B} = \dfrac{1}{A - 10}$ ... ②

By placing the value of $\dfrac{1}{B}$ from 2 in to 1 , we get

$$\dfrac{1}{A} + \dfrac{1}{A-10} = \dfrac{8}{75} \qquad \ldots 1$$

Or, $\qquad \dfrac{A-10+A}{A^2-10A} = \dfrac{8}{75}$

Or, $\qquad \dfrac{A-5}{A^2-10A} = \dfrac{4}{75}$

Or, $\qquad 75A - 375 = 4A^2 - 40A$

Or, $\qquad 4A^2 - 40A - 75A + 375 = 0$

Or, $\qquad 4A^2 - 115A + 375 = 0$

Or, $\qquad 4A^2 - 100A - 15A + 375 = 0$

Or, $\qquad 4A\left(A-25\right) - 15\left(A-25\right) = 0$

Or, $\qquad \left(A-25\right)\left(4A-15\right) = 0$

A = 25 hours $\qquad \left(A \neq \dfrac{15}{4} \text{ hours, because B becomes negative.} \right)$

So, B = 25 − 10 = 15 hours

OR

Let L be the length of the rectangle.

So, breadth of the rectangle $= L - 3$

Area of the rectangle $= L\,(L - 3)$ ... 1

Base of the isosceles triangle $= L - 3$

Altitude of the isosceles triangle $= 12$ m

Area of the isosceles triangle $= \dfrac{1}{2}\,(12)\,(L - 3)$ ... 2

Given that

$$L\,(L - 3) = \dfrac{1}{2}\,(12)\,(L - 3) + 4$$

Or, $L^2 - 3L = 6L - 18 + 4$

Or, $L^2 - 9L + 14 = 0$

Or, $L^2 - 7L - 2L + 14 = 0$

Or, $L\,(L - 7) - 2\,(L - 7) = 0$

Or, $(L - 7)(L - 2) = 0$

So, $L = 7\,\text{m}$ $(L \neq 2 \;\because\; L - 3 \text{ is negative.})$

Breadth $= 7\,\text{m} - 3\,\text{m} = 4\,\text{m}$

Length and breadth of the rectangle are 7m and 4m respectively.

40. **Draw a 'less than' ogive for the following frequency distribution:**

Classes:	0-10	10–20	20–30	30–40	40–50	50–60	60–70	70–80
Frequency:	7	14	13	12	20	11	15	8

Answer:

Marks	Cumulative frequency
Less than 10	7
Less than 20	7 + 14 = 21
Less than 30	21 + 13 = 34
Less than 40	34 + 12 = 46
Less than 50	46 + 20 = 66
Less than 60	66 + 11 = 77
Less than 70	77 + 15 = 92
Less than 80	92 + 8 = 100

Marks	Frequency(f)	Cumulative frequency (cf)
0 – 10	7	7
10 – 20	14	21
20 – 30	13	34
30 – 40	12	46
40 – 50	20	66
50 – 60	11	77
60 – 70	15	92
70 – 80	8	100

Now, plot (10, 7), (20, 21), …, (80, 100) on the graph.