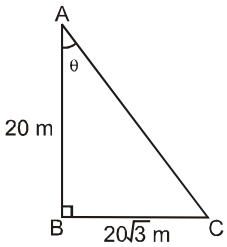
HINTS & SOLUTIONS

1. Mathematics

1. $\angle APB = 80^\circ$
So, $\angle APO = 40^\circ$
$\angle OAP = 90^\circ$
In ΔOAP
$\angle AOP = 180^\circ - (\angle OAP + \angle OPA)$
$\angle AOP = 180^\circ - (90^\circ + 40^\circ)$
$\angle POA = 50^\circ$

2.



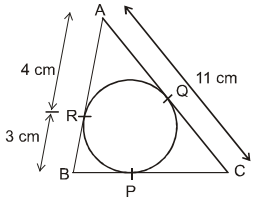
$\tan\theta = \frac{BC}{AB} = \frac{20\sqrt{3}}{20} = \sqrt{3}$
$\tan\theta = \sqrt{3}$
$\therefore \theta = 60^\circ$.

3. Since the required point (say P) is on the X-axis, its ordinate will be zero. Let the abscissa of the point be x.
Therefore, coordinates of the point P are (x, 0).
Let A and B denote the points (5, 4) and (– 2, 3), respectively.
Since we are given that AP = BP, we have
$AP^2 = BP^2$
i.e., $(x - 5)^2 + (0 - 4)^2 = (x + 2)^2 + (0 - 3)^2$
or $x^2 + 25 - 10x + 16 = x^2 + 4 + 4x + 9$
or $- 14x = -28$
or $x = 2$
Thus, the required point is (2, 0).

4. $D = 0$
$(3k)^2 - 4 \times 4 (9) = 0$
$k^2 = \frac{144}{9}$
$k = \pm 4$

5. Since, x + 1, 3x and 4x + 2 are in A.P.
$\therefore$ $2 (3x) = x + 1 + 4x + 2$
$\Rightarrow$ $6x = 5x + 3$
$\Rightarrow$ $x = 3$.

6.



BR = BP
[Tangents drawn to a circle from a point outside the circle are equal]
However, BR = 3 cm

BP = 3 cm … (i)
AR = AQ
[Tangents drawn to a circle from a point outside thecircle are equal]
∴ However, AR = 4 cm
AQ = 4 cm
AQ + QC = AC
⇒ QC = AC – AQ
Using the values AQ = 4 cm and AC = 11 cm,
QC = 11 cm – 4 cm
⇒ QC = 7 cm
CP = CQ
[Tangents drawn to a circle from a point outside thecircle are equal]
∴ CP = 7 cm … (ii)
BC = BP + CP
On using equations (i) and (ii), we obtain
BC = 3 cm + 7 cm
BC = 10 cm
Thus, the length of BC is 10 cm.

7. We have, AD = 3AB. Therefore, BD = 2 AB. Thus D divides AB externally in the ratio AD : BD = 3 : 2.
Hence, the coordinates of D are

A(1,1) B(2,–3) D

$\left(\frac{3\times 2-2\times 1}{3-2}, \frac{3\times -3-2\times 1}{3-2}\right)$

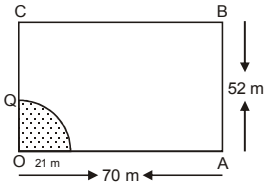
= (4, –11).

8. Let x be one of the positive integers. Then the other integer is x + 1, xz^+
Since the sum of the squares of the integers is 545, we get
$x^2 + (x + 1)^2 = 545$
or $2x^2 + 2x – 544 = 0$
or $x^2 + x – 272 = 0$
$x^2 + 17x – 16x – 272 = 0$
or $x(x + 17) – 16(x + 17) = 0$
or $(x – 16)(x + 17) = 0$
Here, x = 16 or x = –17. But, x is a positive integer. Therefore, reject x = – 17 and take **x = 16**. Hence, two consecutive positive integers are 16 and 17.

9. $a_n = S_n – S_{n–1}$
$= 4n^2 – 3n – [4(n – 1)^2 – 3 (n – 1)]$
$= 4n^2 – 3n – [4(n^2 – 2n + 1) – 3n + 3]$
$= 4n^2 – 3n – 4n^2 + 8n – 4 + 3 n – 3$
$= 8n – 7.$

10. 1st number is 105 and last number is 994.
994 = 105 + (n – 1)7
n = 128
Sum, $S_{128} = \frac{128}{2}$ [105 + 994] = 70336.

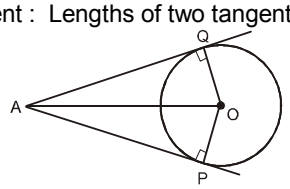
11. Shaded portion indicates the area which the horse can graze. Clearly, shaded area is the area of a quadrant of a circle of radius r = 21 m.
Required area = $\frac{1}{4}\pi r^2$



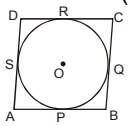
⇒Required area = $\left\{\frac{1}{4}\times\frac{22}{7}\times(21)^2\right\}$ cm^2

⇒Required area = $\frac{693}{2}$ cm^2 = 346.5 cm^2

12. Statement : Lengths of two tangents drawn from an external point to a circle are equal.

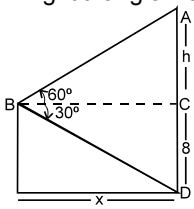


Given : AP and AQ are two tangents drawn from a point A to a circle C (O, r).
To prove : AP = AQ.
Construction : Join OP, OQ and OA.
Proof : In ΔAOQ and ΔAPO
$\angle OQA = \angle OPA$
[Tangent at any point of a circle is perp. to radius through the point of contact]
AO = AO [Common]
OQ = OP [Radius]
So, by R.H.S. criterion of congruency $\Delta AOQ \cong \Delta AOP$
$\therefore$ AQ = AP [By CPCT] **Hence Proved.**
Part (ii) :
Sides AB, BC, CD and DA of a quadrilateral ABCD touch a circle at P, Q, R and S respectively.
To prove : AB + CD = AD + BC.
Proof :
AP = AS ....(i)
BP = BQ ....(ii)
CR = CQ ....(iii)
DR = DS ....(iv)



[Tangents drawn from an external point to a circle are equal]
Adding (1), (2), (3) and (4), we get
$\Rightarrow$ AP + BP + CR + DR = AS + BQ + CQ + DS
$\Rightarrow$ (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)
$\Rightarrow$ AB + CD = AD + BC.

13. Let x be distance of hill from man and h + 8 be height of hill which is required.
In right triangle ACB,



$\Rightarrow \quad \tan 60^\circ = \frac{AC}{BC} = \frac{h}{x}$

$\Rightarrow \quad \sqrt{3} = \frac{h}{x}$

$h = \sqrt{3}\, x$
In right triangle BCD,
$\tan 30^\circ = \frac{CD}{BC} = \frac{8}{x}$
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{8}{x} \qquad \Rightarrow x = 8\sqrt{3}$

$\therefore$ Height of hill = $h + 8 = x\sqrt{3} + 8 = 32$ m.
Distance of ship from hill = $x = 8\sqrt{3}$ m.

14. Let the third vertex be (x_3, y_3), area of triangle
$= \frac{1}{2}\left|[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]\right|$
As $x_1 = 2$, $y_1 = 1$; $x_2 = 3$, $y_2 = -2$; Area of $\Delta = 5$ sq. unit
$\Rightarrow \quad 5 = \frac{1}{2}\left|2(-2 - y_3) + 3(y_3 - 1) + x_3(1 + 2)\right|$

$\Rightarrow \quad 10 = |3x_3 + y_3 - 7|$

$\Rightarrow \quad 3x_3 + y_3 - 7 = 10$

Taking positive sign

$3x_3 + y_3 - 7 = 10 \Rightarrow 3x_3 + y_3 = 17$ ....(i)

Taking negative sign

$\Rightarrow \quad 3x_3 + y_3 - 7 = -10$

$\Rightarrow \quad 3x_3 + y_3 = -3$ ....(ii)

Given that (x_3, y_3) lies on $y = x + 3$

So, $-x_3 + y_3 = 3$ ....(iii)

Solving eq. (i) & (iii)

$x_3 = \frac{7}{2}$, $y_3 = \frac{13}{2}$

Solving eq. (ii) & (iii)

$x_3 = \frac{-3}{2}$, $y_3 = \frac{3}{2}$

So the third vertex are or $\left(\frac{7}{2}, \frac{13}{2}\right)$. $\left(\frac{-3}{2}, \frac{3}{2}\right)$

2. Science (Chemistry)

1. Alloys are homogeneous mixtures of two or more metals, or a metal and a non-metal. For example, steel .

2. (a) Oxides which show both acidic and basic characteristics are known as amphoteric oxides. Example Al_2O_3, ZnO, SnO_2

3. (a) The property of self linking of carbon atoms through covalent bonds to form long straight or branched chains and rings of different sizes is called catenation.
(a) Bromo ethane
(b) Hex-1-yne

2. Science (Biology)

1. Reproduction is the ability of living organisms to produce new living organisms similar to them. It is one of the important characteristic of life.

2.

DIFFERENCES BETWEEN ASEXUAL AND SEXUAL REPRODUCTION	
Asexual reproduction	**Sexual reproduction**
It is always uniparental.	It is generally biparental.
Gametes are not formed.	Gametes are formed
There is no fertilization	Fertilization occurs in it.
It involves mitotic cell division.	It involves meiotic cell division.
Daughter individuals are genetically identical to the parent	Daughter individuals are different from the parents.
It does not contribute to the evolution.	It contributes to the evolution by introducting variation in the offspring

3. **(A)** **Fore brain :** It consists of olfactory lobes, cerebrum and diencephalon.

- **Olfactory lobes :** These are a pair of small, solid, cube shaped bodies. They are fully covered by cerebrum. They receive impulse for smell.
- **Cerebrum :** It is the largest part of the brain.
- It consists of two cerebral hemispheres joined by a band of nerve fibres called corpus callosum.
- Surface of cerebral hemisphere is made up of grey matter, called cerebral cortex.
- It becomes highly folded to increase area for accommodation of more neurons.
- Each cerebral hemisphere into four lobes
  - **(i)** Occipital lobe : Region for visual perception
  - **(ii)** Frontal lobe : For muscular activities
  - **(iii)** Parietal lobe : For touch, smell, temperature and conscious association.
  - **(iv)** Temporal lobe : For auditory reception.
- Cerebrum has sensory areas where impulses are received from sense organs (receptors). Similarly it has a general motor area from where impulses are sent to effector organs (Muscles & glands).
- **Diencephalon :** It encloses a cavity called third ventricle.

- It consists of thalamus and hypothalamus.
- Thalamus serves as a relay centre for sensory and motor impulses from spinal cord & medulla oblongata to cerebrum.
- It recognizes sensory impulses of heat, cold, pain, light & pressure.
- Floor of third ventricle is called hypothalamus.
- It possesses control centres for hunger, thirst, thermoregulation, sleep, sex, stress etc.

4. **Pineal**-It regulates the biological clock (circadian rhythm)

- It contributes in regulating gonadal development. It controls development & concentration of melanin. It secretes **melatonin** hormone.

Thymus- It is one of the sites of lymphocyte formation in children.

- It helps in producing antibodies.

Parathyroid-

(i) It regulates the balance between the calcium in bones and in extracellular tissue fluid, thus affecting the amount of calcium in the blood.

(ii) It also controls the excretion of phosphates in the urine, probably by reducing tubular reabsorption of phosphorus by the kidney tubule.

Adrenal gland- Cortex secretes three different kinds of hormones known as corticosteroids. They are :

(i) **Mineralocorticoids :** These regulate sodium and potassium balance in the body.

(ii) **Glucocorticoids :** These derive their name from their influence on carbohydrate metabolism. e.g. Glycogenesis is promoted in liver.

(iii) **Sex hormones :** Small quantities of sex hormones as androgens and oestrogen are produced by adrenal glands which influence sexual development and growth.

Adrenal medulla : It secretes two hormones.

(i) **Adrenaline :** It is a stress hormone causes increase in systolic blood pressure, dilation of coronary blood vessels, increased sweating and increase in metabolic rate.

It brings restlessness, muscle fatigue and anxiety.

(ii) **Noradrenaline :** It is a general vasoconstrictor, increases both systolic and diastolic pressures.

Both of these hormones are helpful in emergency conditions. Thus are called as **"fight or flight response"** or **3F's.**

5. **(A)** When the F_1 generation was obtained, it was found that the resultant generation would express only one of the trait and not the other.

- The trait which is being expressed is called as dominant, whereas the one which is not expressed is called as recessive trait.

(B) The F_2 generation is obtained by self pollination, the dominant and the recessive traits obtained were in the ratio of 3 : 1 i.e. 75% of the offsprings which appeared in F_2 generation had dominant trait, while 25% had recessive trait. This ratio of 3 : 1 is also said to be known as Mendelian monohybrid ratio.

In F_1 all are tall

($F_1 \times F_1$)

In F_2 we will get 3 : 1 ratio.

Homozygous tall : Heterozygous tall : Homozygous dwarf

1 : 2 : 1

(C) Mendel further found that the phenotypic ratio of 3 : 1 of dominant to recessive form of a trait was actually a genotypic ratio of 1 : 2 : 1 of pure dominant, hybrid and pure recessive forms.

- The traits which remain hidden in F_1 generation got expressed in F_2 generation. This was later on proved in F_3 generation.