# *INDIAN SCHOOL DARSAIT*

***Class XII*** ***Mathematics Worksheet***

## *Worksheet # 12 Application of Derivatives # 1*

## *Rate of Change*

## *(Chapter – 6 : Application of Derivatives)*

| ***CLASS WORK*** | |
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| 1. | Find the rate of change of the area of a circle with respect to its radius r when (a) r = 3 cm (b) r = 4 cm |
| 2. | The radius of a circle is increasing at the rate of 0.7 cm/s. What is the rate of increase of its circumference? |
| 3. | The radius of a circle is increasing uniformly at the rate of 3 cm/s. Find the rate at which the area of the circle is increasing when the radius is 10 cm. |
| 4. | An edge of a variable cube is increasing at the rate of 3 cm/s. How fast is the volume of the cube increasing when the edge is 10 cm long? |
| 5. | The volume of a cube is increasing at the rate of 8 cm3/s. How fast is the surface area increasing when the length of an edge is 12 cm? |
| 6. | A balloon, which always remains spherical on inflation, is being inflated by pumping in 900 cubic centimetres of gas per second. Find the rate at which the radius of the balloon increases when the radius is 15 cm. |
| 7. | The length x of a rectangle is decreasing at the rate of 5 cm/minute and the width y is increasing at the rate of 4 cm/minute. When x = 8cm and y = 6cm, find the rates of change of (a) the perimeter, and (b) the area of the rectangle |
| 8. | A particle moves along the curve $6y = x^3 + 2$. Find the points on the curve at which the y-coordinate is changing 8 times as fast as the x-coordinate. |
| 9. | Sand is pouring from a pipe at the rate of 12 cm3/s. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is 4 cm? |
| 10. | The total cost C(x) in Rupees associated with the production of x units of an item is given by C(x) = 0.007x3 – 0.003x2 + 15x + 4000. Find the marginal cost when 17 units are produced. |
| 11. | The total revenue in Rupees received from the sale of x units of a product is given by R(x) = 13x2 + 26x + 15. Find the marginal revenue when x = 7. |
| 12. | A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lowermost. Its semi – vertical angle is $\tan^{-1}(0.5)$. Water is poured into it at a constant rate of $5m^3$/minute. Find the rate at which the level of the water is rising at the instant when the depth of the water in the tank is 10m. |
| 13. | A man of height 2m walks at a uniform speed of 5km/h away from a lamp post which is 6m high. Find the rate at which the length of the shadow increases. |
| 14. | A spherical ball of salt is dissolving in water in such a way that the rate of decrease of volume at any instant is proportional to the surface area. Prove that the radius is decreasing at a constant rate. (NCERT Exemplar Question) |
| 15. | A kite is moving horizontally at a height of 151.5 meters. If the speed of the kite is 10m/s, how fast is the string being let out, when the kite is 250m away from the boy who is flying the kite? The height of the boy is 1.5m (NCERT Exemplar Question) |

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## Worksheet # 12 Application of Derivatives # 1

## Rate of Change

## (Chapter – 6 : Application of Derivatives)

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| 16. | Two men A and B starts with velocities v at the same time from the junction of two roads inclined at 45° to each other. If they travel by different roads, find the rate at which they are separated. (NCERT Exemplar Question) |
| | ***HOME WORK*** |
| 17. | A stone is dropped into a quiet lake and waves move in circles at the speed of 5 cm/s. At the instant when the radius of the circular wave is 8 cm, how fast is the enclosed area increasing? |
| 18. | A balloon, which always remains spherical has a variable radius. Find the rate at which its volume is increasing with the radius when the later is 10 cm. |
| 19. | A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2cm/s. How fast is its height on the wall decreasing when the foot of the ladder is 4 m away from the wall ? |
| 20. | The radius of an air bubble is increasing at the rate of ½ cm/s. At what rate is the volume of the bubble increasing when the radius is 1 cm? |
| 21. | A balloon, which always remains spherical, has a variable diameter $\frac{3}{2}(2x+1)$ Find the rate of change of its volume with respect to x. |
| | If the area of a circle increases at a uniform rate, prove that the perimeter increases inversely as the radius. (NCERT Exemplar Question) |
| 22. | A man 2m tall, walks at the rate of $1\frac{2}{3}m$ towards a street light which is $5\frac{1}{3}m$ above the ground. At what rate is the tip of his shadow moving? At what rate is the length of his shadow changing when he is $3\frac{1}{3}m$ from te base of the light. (NCERT Exemplar Question) |
| 23. | A swimming is to be drained for cleaning. If L represents the number of litres of water in the pool t seconds after the pool has been plugged off to drain and $L = 200(10-t)^2$ . How fast is the water running out at the end of 5 seconds? What is the average rate at which the water flows out during the first 5 seconds? (NCERT Exemplar Question) |
| 24. | The volume of a cube increases at a uniform rate. Prove that the increase in surface area varies inversely as the length of the side. (NCERT Exemplar Question) |
| 25. | x and y are the sides of two squares such that $y = x - x^2$. Find the rate of change of area of the second square to that of the first square. (NCERT Exemplar Question) |
| 26. | Two sides of an isosceles triangle with fixed base b are decreasing at the rate of 3cm/sec. How fast is the area decreasing when the two sides are equal to the base? (NCERT Exemplar Question) |
| 27. | From a cylindrical drum containing petrol and kept vertical , the petrol is leaking at the rate of $10cm^3$/sec. If the radius of the drum is 25cm and height is 1m , find the rate at which the level of the petrol is changing when the petrol level is 80cm. (NCERT Exemplar Question) |
| 28. | Water is dripping out from a conical funnel of semi – vertical angle $\frac{\pi}{4}$ at the uniform rate of $2cm^2$/sec in the surface area, through a tiny hole at the vertex at the bottom. When the slant height of the cone is 4cm, find the rate of decrease of the slant height of the water. (NCERT Exemplar Question) |

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| 29. | Water is running into a conical funnel 15cm deep and 5cm in radius, at the rate of $0.1cm^3/sec$. When the water is 6cm deep , find at what rate<br>i) water level rising ii) water surface area increasing iii) wet surface area of the vessel is increasing. (NCERT Exemplar Question) |