Differentiation 3

1.Find the coordinates of the stationary points of the curve $y = t^{\frac{1}{2}}(\frac{3}{4} - t)$ and determine their nature

2.Find the coordinates of the stationary points of the curve $y = (3x-2)^3 - 9x$ and determine their nature

3.Find the coordinates of the stationary points of the curve $y = \frac{1+54x^3}{x^2}$ and determine their nature

4.Find the coordinates of the stationary points of the curve $y = x^4 - 2x^3 + x^2 - 2$ and determine their nature. Sketch the curve

5.Show that the curve $y = 3x^3 - 5x^2 + 3x + 4$ has no stationary points

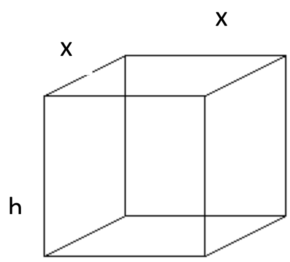
6. $f(x) = 3x^2 + 2x + 5$, $g(x) = x^3 - 4x^2 - 3x + 6$

a. Show that there is one value of x for which f(x) and g(x) have the same stationary value
b. On the same axes sketch the graph of f(x) and g(x)

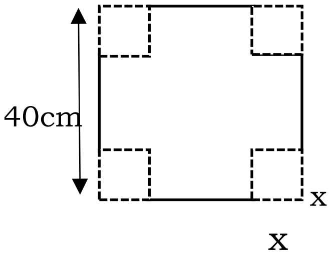
7.The curve $y = ax^2 + bx + c$ has a minimum when $x = \frac{1}{2}$ and passes through the points (2,0) and (1,-3). Find the values of a, b and c

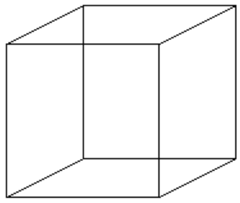
8.A farmer has a rectangular piece of land for pigs. One of the sides of the rectangle is a wall. The other three sides have fencing. The fencing is 80m in length. Find the maximum possible area of this rectangular piece of land

9.An open box with a square bas has a total surface of 300cm^2. Find the greatest possible volume of the box



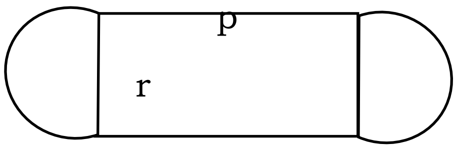
10.Figure one shows a square sheet of metal of side 40cm. A square x cm by x cm is cut from each corner. The sides are then bent upwards to form an open box as shown in figure 2. Find the value of x that maximizes the volume of the box





11.Given that $x + y = 3$, find the least possible value of $x^2 + 14y$

12.The diagram shows a sporting track made up of a rectangle with semicircles at each end. The rectangle has dimensions p metres by 2r metres where r is the radius of each semicircle. The perimeter of the track is 1400m. The track has a maximum area for this perimeter. Find the value of p and the value of r.



13.Find the maximum possible value of x^2y if $x + 2y = 8$

14.A cylinder with an open top has radius r cm and a volume of 512π cm^3.

a. Write down the surface area of the cylinder in terms of r

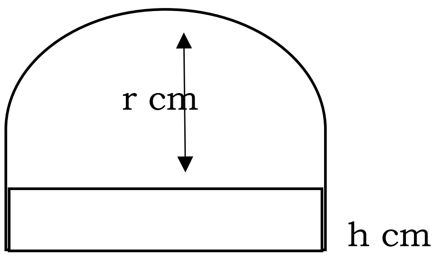
b. Find the minimum surface are. Leave your answer in terms of π

c. Find the value of r and the height of the cylinder

15.a sector of a circle, radius r has a perimeter of 20cm. The angle of the sector is θ radians and the area is Acm^2. Find the maximum possible area of the sector.

16.A tank in the shape of a right circular cylinder with no top has a surface area of 3π m^2. What height and base radius will maximize the volume of the cylinder?

17.The diagram shows a semicircle on top of a rectangle. The perimeter of the shape is 20cm. Find the maximum area of the rectangle.



18. $w = pq$ and $2p + 5q = 100$. Find the maximum value of W.

19.A spherical balloon is being blown up so that its radius increases at a rate of 0.4cm s^{-1}. Find the rate of increase of the surface area of the balloon when the radius is 20cm.

20.The radius of a circular ink blob is increasing at a rate of 5cm s^{-1}. Find the exact rate of increase of the circumference of the circle.

21.The side of a cube is increasing at 0.2 ms^{-1}. Find the rate of increase of the volume when the length of the side is 4cm.

22.A spherical balloon is inflated so that its volume increases at the rate of 50cm^3s^{-1}. Find the rate of increase of the radius of the balloon when the radius is 12cm.

23.The side of a cube is decreasing at a rate of 0.4cm s^{-1}. Find the rate of decrease of the surface area when the length of the side is 3cm.

24.A cone has a height of 7cm. The radius of the base of the cone is increasing at a rate of 8cm s^{-1}. Find the rate of change of the volume of the cone when the base radius is 5cm.

25.The volume of a cube is increasing at the rate of 12 cm^3s^{-1}.Find the rate of increase of the surface area of the cube when the side of the cube is 7cm.

26.The surface area of a cube is increasing at 0.3m^2s^{-1}. Find the rate of increase of the volume of the cube when the length of the side is 5m.

27.A cuboid has a square base. The height of the cuboid is twice the length of the side of the base. The surface area of the cuboid is increasing at a rate of 10cm^2s^{-1}. Find the rate of increase of the volume of the cuboid when the height of the cuboid is 12cm.