**Find .**

1) f(x) = 3x4 – 6x3 + 1

2) f(x) = 

3) f(x) = 3x2 + 

**4)** (a) Differentiate the following function with respect to *x*:

 *f* (*x*) = 2*x* – 9 – 25*x–*1

(b) Calculate the *x*-coordinates of the points on the curve where the gradient of the tangent to the curve is equal to 6.

**5)** Consider the function *f* (*x*) = 2*x*3 – 3*x*2 – 12*x* + 5.

(a) (i) Find *f* ' (*x*).

(ii) Find the gradient of the curve *f* (*x*) when *x* = 3.

(b) Find the *x*-coordinates of the points on the curve where the gradient is equal to –12.

(c) (i) Calculate the *x*-coordinates of the local maximum and minimum points.

(ii) Hence find the coordinates of the local minimum.

(d) For what values of *x* is the value of *f* (*x*) increasing?

6) An open box has a square base of side *x* and height *h*.

 a) Write down an expression for the volume, V, of the box.

 b) Write down an expression for the total surface area, A, of the box.

 The volume of the box is 1728 cm3.

 c) Express h in terms of x.

 d) Hence show that A = 6912x-1 + x2.

 e) Find .

 f) Calculate the value of x that gives a minimum surface area.

 g) Find the surface area for this value of x.

**7)** Consider the function *f* (*x*) = 

(a) Find *f* ′ (*x*).

 (b) Find *f* ′′ (*x*).

 (c) Find the equation of the tangent to the curve of *f* at the point (1, 1.5).

8) *f(x)* = x4 – 2x2

 (a) Calculate *f’(x)*

 (b) Determine the coordinates of any stationary points.

 (c) Determine the nature of any stationary points

 (d) Find where the graph intersects or touches:

 i) the y-axis

 ii) the x-axis

 (e) Sketch the graph of *f(x)*

9) A stone is thrown vertically downwards off a tall cliff. The distance (s) it travels in metres is given by the formula s = 4t + 5t2, where t is the time in seconds after the stone’s release.

 (a) What is the rate of change of the distance with time $\frac{ds}{dt}$ (This represents the velocity.)

 (b) How many seconds after its release is the stone travelling at a velocity of 9 m s-1 ?

 (c) The stone hits the ground travelling at 34 m s-1. How many seconds did the stone take to hit the ground?

 (d) Using your answer from part **c**, calculate the distance the stone falls and hence the height of the cliff.

10) The temperature (*T °C)* inside a pressure cooker is given by the formula T = 20 + 12t2 – t3 ; t ≤ 8, where *t* is the time in minutes after the cooking started.

 (a) Calculate the temperature at the start.

 (b) What is the rate of temperature increase with time?

 (c) What is the rate of temperature increase when:

 i. t = 1 ii. t = 4 iii. t = 8

(d) The pressure cooker is turned off when $\frac{dT}{dt}=36$ How long after the start could the pressure cooker have been switched off?

(e) What was the temperature of the pressure cooker if it was switched off at the greater of the two times calculated in part **d**?

11) A function is given as $y=ax^{2}+bx+6.$

 a) Find $\frac{dy}{dx}$.

 b) The gradient of this function is 2 when x is 6.

 Write an equation in terms of $a$ and $b$.

 c) The point $(3,-15)$ lies on the graph of the function.

 Find a second equation in terms of $a$ and $b$.

 d) Use your GDC and your equations from parts b) and c) to find the values of $a$ and $b$.

12) Given the following function: $f\left(x\right)=3x^{2}-2x+5$

a) Calculate the equation of a tangent line passing through x = 2

b) Calculate the equation of a tangent line passing through x = -1

13) f(x) = (x – 2)2 + 3

 a) Calculate f’(x)

 b) Determine the range of values of x for which f(x) is decreasing

14) Differentiate the following functions with respect to x. Then find the second derivative.

 a)f(x) = x(x + 2)

 b)f(x) = (x + 2)(x – 3)

 c) f(x) = $\frac{x^{3}-x}{x}$

 d) f(x) = $\frac{1}{2x^{2}}+x$

15) What is the derivative of a function?

16) If the derivative of a function at a given point is positive, what does that mean?

17) If the derivative of a function at a given point is 0, what does that mean?