**SUMMARY OF CALCULUS 2.**

*1. Find the gradient of y = 5 + 7x + x4*

*when x = 1*

*y' = 7 + 4x3*

*sub x = 1 and y' = 11*

*2. State whether the graph of*

*y = x3 – 12x2 + 36x is increasing,*

*decreasing or stationary*

*y' = 3x2 – 24x + 36 = 3(x2 – 8x + 12)*

*= 3(x – 2)(x – 6)*

*when*

*(a) x = 4*

*y' = neg so decreasing*

*(b) x = 2*

*y' = 0 so stationary*

*(c) x = 7*

*y' = positive so increasing*

*3. Find the x coordinates of the turning points (ie max/ min points) of the graph*

*y = x2(x – 4)2*

*y = x2(x2 – 8x + 16)*

*y = x4 – 8x3 + 16x2*

*y' = 4x3 – 24x2 + 32x = 0 at max/min*

*= 4x(x2 – 6x + 8)*

*= 4x(x – 2)(x – 4)*

*x = 0, 2, 4*

*Using 2nd derive test:*

*y' ' = 12x2 – 48x + 32*

*if x = 0 then y' ' = positive so min point*

*if x = 2 then y' ' = negative so max pt*

*if x = 4 then y' ' = positive so min point*

*4. Consider this piecewise graph:*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

*Draw the gradient function:*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

*5. If y' = – 2x + 5*

*find the equation for y if the curve*

*goes through (1, 7)*

*y = - x2 + 5x + c*

*sub x = 1, y = 7*

*7 = -1 + 5 + c*

*3 = c*

***Equ is y = -x2 + 5x + 3***

*6. Find the equation of the tangent to*

*y = x2 – 2x +1 at the point where*

*x = 3* ***so y = 4***

*y' =2x – 2 sub x = 3 so y' = 4*

*tan is of form y = mx + c*

*so 4 = 4×3 + c*

*c = -8*

***tan is y = 4x – 8***

*7. The distance, x of an object from O at t secs is given by :*

*x = t2 – 2t + 4*

*(a) how far from O is it at t = 0 sec?*

*x = 4 metres*

*(b) how far from O is it at t = 5 sec?*

*x = 25 – 10 + 4 = 19 metres*

*(c) find the velocity equation*

*v = dx = 2t – 2*

*dt*

*(d) find the velocity at t = 0 sec*

*v = -2 m/s*

*(e) find the velocity at t = 5 sec*

*v = 8 m/s*

*(f) find the acceleration equation*

*a = dv = 2 m/s/s*

*dt*

*8. A gun is fired so that the bullet goes vertically upwards.*

*The height of the bullet at t sec is*

*H = 80t – 5t2 + 2*

*(a) how high was the gun as the bullet was fired?*

*When t = 0, H = 2 metres*

*(b) find the velocity equation.*

*v = 80 – 10t*

*(c) find the time when the velocity of*

*the bullet was zero.*

*80 – 10t = 0 so t = 8 sec*

*(d) find the greatest height reached by*

*the bullet.*

*H = 80×8 – 5×82 + 2 = 322 metres*

*(e) what was the initial velocity of the*

*bullet?*

*t = 0 so v = 80 m/sec*

*(f) how far did the bullet travel in the 4th second? (from t = 3 to t = 4) .*

*When t = 3, H = 197 m*

*When t = 4, H = 242 m*

*So dist = 242 – 197 = 45 metres*

*9. The velocity of an object is given by*

*v = 4t3 – 8t m/s*

*Find the distance equation given that at t = 2 sec the distance x = 10 m*

*x = t4 – 4t2 + c*

*sub t = 2, x = 10*

*10 = 16 – 16 + c*

*So c = 10*

*So* ***x = t4 – 4t2 + 10***

*10. This is the gradient graph of a function y = f(x)*

*y'*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

*Draw the function:*

*y*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |