 **Methods 11 Investigation 3 2018**

**Calculus**

**Total Marks: 52 Time Allowed: 55 minutes**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Classpad allowed**

**All electronic devices must be switched off and in student bags.**

**ALL** working must be shown for full marks.

**1.** **[2 marks]**

Describe a method that can be used to determine the gradient at a point P, for any given function. Eg. Describe how to determine the gradient to the tangent at the point x = 2 for the function .

**2.** **[2 marks]**

Using your description from part 2 to write a rule that links the function and the “gradient of the tangent” to the function at a point x for the function

The “gradient of the tangent” can be determined by *y =* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This is referred to as the “**gradient formula**.” (Hint: Use *y, x, and n in your formula)*

**3. [8 marks]**

For the functions below, determining the gradient of the tangent at the point, P, when x = 2.

(Use x = 2.1, x = 2.01, x = 2.001 as the x value of your Q points)

Place answers in the table below. (4 d.p.)

a)

b)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Gradient of PQ when  x = 2.1 | Gradient of PQ when  x = 2.01 | Gradient of PQ when  x = 2.001 | **Gradient Approaches** |
|  |  |  |  |  |
|  |  |  |  |  |

**4. [8 marks]**

For the functions below, determining the gradient of the tangent at the point, P, when x = 2. (Use x = 2.1, x = 2.01, x = 2.001 as your Q points) Place answers in the table below. (4 d.p.)

a)

b)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Gradient of PQ when  x = 2.1 | Gradient of PQ when  x = 2.01 | Gradient of PQ when  x = 2.001 | **Gradient Approaches** |
|  |  |  |  |  |
|  |  |  |  |  |

**5. [8 marks]**

For the functions below, determining the gradient of the tangent at the point, P, when x = 2. (Use x = 2.1, x = 2.01, x = 2.001 as your Q points) Place answers in the table below. (4 d.p.)

a)

b)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Gradient of PQ when  x = 2.1 | Gradient of PQ when  x = 2.01 | Gradient of PQ when  x = 2.001 | **Gradient Approaches** |
|  |  |  |  |  |
|  |  |  |  |  |

**6. [6 marks]**

Fill in the table with the gradient of the tangent acquired in parts 3-5. (To nearest whole number)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| x = 2 |  |  |  |  |  |  |

**7.** **[2 marks]**

Describe a method that can be used to determine the gradient at a point P, for any given function.

Eg. Describe how to determine the gradient to the tangent at the point x = 2 for the function

**8.** **[2 marks]**

Using your description from part 8, modify your rule from part 4 to write a rule that links the function and the “gradient of the tangent” to the function at a point x when the coefficient to x is greater than 1 for the function

The “gradient of the tangent” can be determined by *y =* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This is referred to as the “**gradient formula**.” (Hint: Use *y, x, and n in your formula)*

**9.** **[2, 2, 2, 2 = 8 marks]**

Use your rule to determine the **gradient formula** for the following functions.

a) gradient formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) gradient formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) gradient formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d) gradient formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**10.** **[2, 2, 2 = 6 marks]**

Use your rule to determine:

a) The gradient formula for the function

b) the gradient of the tangent at the point (2, 32)

c) the equation of the tangent line at the point (2, 32).