

Methods 11 Investigation 3 2018 Calculus

Total Marks: 52

Time Allowed: 55 minutes

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. Eq. Describe how to determine the gradient to the tangent at the point x = 2 for the D) For the Runchion equation, make the index the visites the coefficient, and reduce the interior by one. Then put the x value into The equation to hind the gradient at the paint on the further. function $y = x^7$.

@ test same values, a may get closer to The point P and determine he limit of has value.

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 $y = \frac{n-1}{2}$ to as the "gradient formula" (1) _____. This is referred to as the "gradient formula." (Hint: Use y, x, and n in your formula)

 $M = \frac{(x+h)^n - x^n}{as h \to 0}$

Values outside the box are finding the : gradient at the points 2-1, 2.01 and 2.001. 3. [8 marks] values not to 4 dp. lose one mark each. Values beyond 4 dp lose one mark only for This page. Repeat the table above 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)
$$y = 2x^3$$

$y = 2x^4$	26.46	24.2406	24.0240	
	Gradient when $x = 2.1(p/Q)$	Gradient when x = 2.01	Gradient when × = 2.001	Gradient Approaches
$y = 2x^3$	22.33	24-1202	24.0120	24
$y = 2x^4$	68.962	64.4816	64.0480	64

64.9648 64.0960 74.0880

[8 marks]

Repeat the table above 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.)

 $v = 3x^3$ a)

b)	$y = 3x^4$	39.69	36.3609	36.0360
		2/10/	20.00	90.0300

	71.01		90000	
	Gradient when x = 2.1	Gradient when x = 2.01	Gradient when x = 2.001	Gradient Approaches
$y = 3x^3$	37.83	36.1803	36.0180	36
$y = 3x^4$	103-443	96.7224	96.0720	96
	111 120	A. 1.1.17.A	0/	

97.4472 96.1441 111-154

5. [8 marks]

Repeat the table above 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)
$$y = 10x^3$$

	132.3	121.203	120. 1200	
··	Gradient when	Gradient when	Gradient when	Gradient
	x = 2.1	x = 2.01	x = 2.001	Approaches
$y = 10x^3$	126-1	120.601	122-0600	120
$y = 10x^4$	344.84	322-4060	320-2401	320

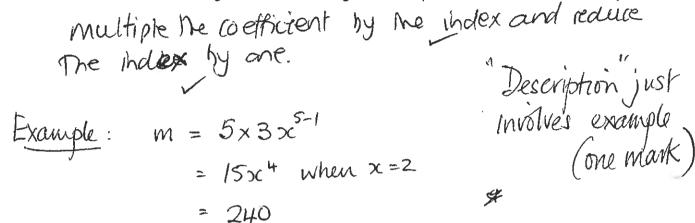
6. [6 marks]

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

	$y=2x^3$	$y=2x^4$	$y = 3x^3$	$y = 3x^4$	$y = 10x^3$	$y = 10x^4$
x = 2	24	64	36	96	120	330
	/					V

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 $y = 3x^5$



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 $y = ax^n$

The "gradient of the tangent" can be determined by $y = \frac{n}{2}$. 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)
$$y = 4x^5$$

gradient formula $f'(x) = \partial O x$

b)
$$y = 3x^2$$

gradient formula f(h) = 6x

c)
$$y = x^5$$

gradient formula $f'(x) = 5x^{4}$

d)
$$y = \frac{x^9}{3}$$

gradient formula f'(x) = 3x

non-simplified answers count only.

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

Use your rule to determine:

a) The gradient formula for the function $y = 2x^4$

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

$$f'(x) = 8(2)^3 \checkmark$$

= 64 \(\sigma\)

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

$$y = mx + c$$

 $32 = 64(2) + c$
 $c = -96$
 $y = 642c$
 $y = 642c$