Unit 1 Pre-Test Review – Derivative Rules Unit 1

MCV4U

Jensen

1) Differentiate each function.

a) $h(t) = t^3 - 2t^2 + \frac{1}{t^2}$ **b)** $p(n) = -n^5 + 5n^3 + \sqrt[3]{n^2}$ **c)** $p(r) = r^6 - \frac{2}{5\sqrt{r}} + r - 1$

2) Differentiate using the product rule.

a) $f(x) = (5x + 3)(2x - 11)$ **b)** $h(t) = \left(2t^2 + \sqrt[3]{t}\right)(4t - 5)$

c) $g(x) = (-1.5x^6 + 1)(3 - 8x)$ **d)** $p(n) = (11n + 2)(-5 + 3n^2)$

3) Determine an equation for the tangent to the graph of $y = (-3x + 8)(x^3 - 7)$ at $x = 2$.

4) Determine $f''(-2)$ for $f(x) = (4 - x^2)(3x + 1)$

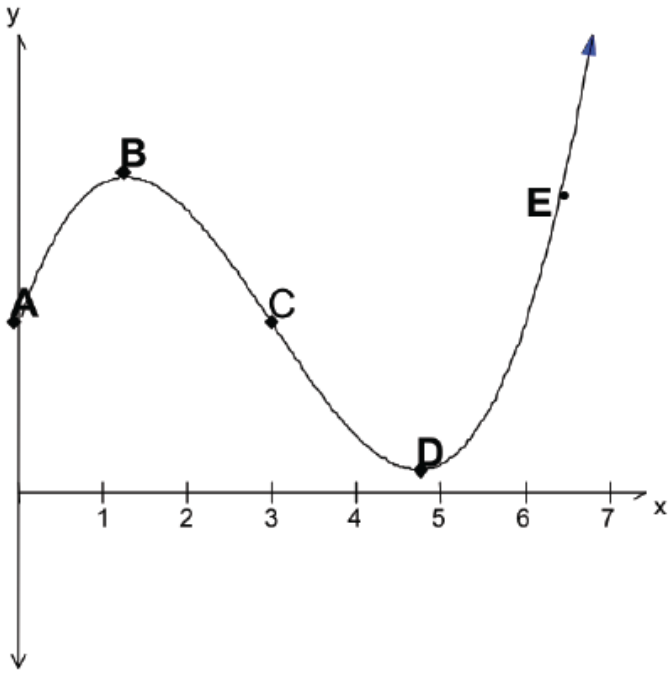
5) Determine the first and second derivative of each function.

a) $g(x) = \frac{2}{3}x^3 + \frac{1}{2}x^4 - 3$

b) $h(x) = (2x - 3)(3x + 1)$

6) For the distance time graph given,

a) sketch the velocity and acceleration function.



b) Complete the table to determine the motion of the object.

Interval	$\boldsymbol{v(t)}$	$\boldsymbol{a(t)}$	$v(t) \times a(t)$	**Slope of** $\boldsymbol{s(t)}$	**Motion of particle**
(A, B)					
(B, C)					
(C, D)					
(D, E)					

7) A toy missile is shot into the air. Its height, h, in meters, after t seconds can be modelled by the function $h(t) = -4.9t^2 + 15t + 0.4, t \geq 0.$

a) Determine the height of the toy missile at 2 seconds.

b) Determine the rate of change of the height of the toy missile at 1 s and 4 s.

c) How long does it take the toy missile to return to the ground?

d) How fast was the toy missile travelling when it hit the ground?

8) Differentiate using the quotient rule.

a) $y = \frac{x-2}{2x+5}$

b) $y = \frac{x^2-4}{2x+5}$

9) Determine the slope of the tangent to $y = \frac{3x}{x^2-4x+3}$ at $x = 4$.

10) Differentiate each of the following.

a) $f(x) = (3x-2)^2$

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

c) $h(x) = \sqrt[3]{3x + 5x^4}$

d) $f(x) = (2x-3)^3(3x-1)^2$

e) $y = \frac{(2x-5)^4}{(x+1)^3}$

f) $y = \frac{8x^3}{\sqrt{3x-2}}$

11) Find an equation for the tangent at $x = 1$ to the curve $y = \left(\frac{2x}{x+1}\right)^6$.

12) Find all tangents to the curve $y = 4x^3$ that have slope of 3.

13) Suppose a particle travels according to the position function in meters $s(t) = \frac{t^3}{3} - 2t^2 + 3t - 4$.

a) At what two times is the particle stationary (stopped)? That is, when is the velocity zero.

b) How far does the particle travel between the two stationary times?

14) When the price is $1.75 each, 3000 fruit bars will be sold. If the price of a fruit bar is raised to $2.00, sales will drop to 2500.

a) Determine the demand, or price, function

b) Determine the marginal revenue from the sale of 2700 bars

c) The cost for the bars is given by the function $C(x) = 30 + 0.25x$. Determine the marginal cost of purchasing 3000 bars.

d) Determine the marginal profit function for the sale of the fruit bars.

e) Determine the marginal profit from the sale of 3000 bars.

15) The mass, in grams, of the first x meters of a wire is represented by the function $f(x) = \sqrt{4x - 1}$.

a) Determine the average linear density of a segment of the wire from $x = 3$ to $x = 7$.

b) Determine the linear density at $x = 4$ and $x = 10$. What does these values confirm about the wire?

Answers:

1)a) $h'(t) = 3t^2 - 4t - \frac{2}{t^3}$ **b)** $p'(n) = -5n^4 + 15n^2 + \frac{2}{3\sqrt[3]{n}}$ **c)** $p'(r) = 6r^5 + \frac{1}{5\sqrt{r^3}} + 1$

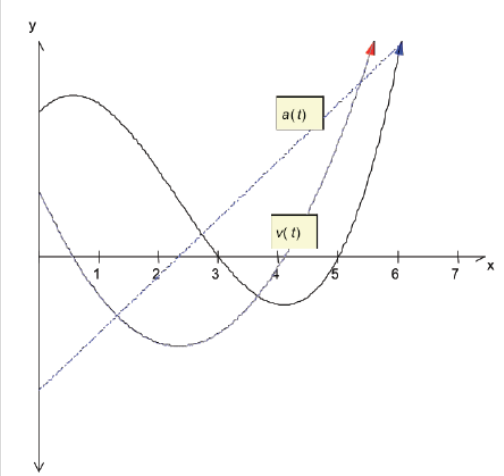
2)a) $f'(x) = 20x - 49$ **b)** $h'(t) = 24t^2 - 20t + \frac{16}{3}t^{\frac{1}{3}} - \frac{5}{3t^{\frac{2}{3}}}$ **c)** $g'(x) = 84x^6 - 27x^5 - 8$ **d)** $p'(n) = 99n^2 + 12n - 55$

3) $y = 21x - 40$

4) 34

5)a) $g'(x) = 2x^2 + 2x^3 \quad g''(x) = 4x + 6x^2$ **b)** $h'(x) = 12x - 7 \quad h''(x) = 12$

6)a)



b)

Interval	$v(t)$	$a(t)$	$v(t) \times a(t)$	Slope of $s(t)$	Motion of particle
(A, B)	+	-	-	positive slope that is decreasing	Slowing down and moving forward
(B, C)	-	-	+	Negative slope that is decreasing	Speeding up and moving in reverse
(C, D)	-	+	-	Negative slope that is increasing	Slowing down and moving in reverse
(D, E)	+	+	+	Positive slope that is increasing	Speeding up and moving forward

7)a) 10.8 m **b)** 5.2 m/s at 1 second; -24.2 m/s at 4 seconds **c)** 3.088 seconds **d)** -15.26 m/s

8)a) $y' = \frac{9}{(2x+5)^2}$ **b)** $y' = \frac{2x^2+10x+8}{(2x+5)^2}$

9) $-\frac{13}{3}$

10)a) $f'(x) = 18x - 12$ **b)** $y' = 162x^5 - 135x^4 + 36x^3 - 3x^2$ OR $y' = 3(3x^2 - x)^2(6x - 1)$ **c)** $h'(x) = \frac{20x^3+3}{3(\sqrt[3]{3x+5x^4})^2}$

d) $f'(x) = 6(2x - 3)^2(3x - 1)(5x - 4)$

e) $y' = \frac{(2x-5)^3(2x+23)}{(x+1)^4}$ **f)** $\frac{dy}{dx} = \frac{12x^2(5x-4)}{(3x-2)^{\frac{3}{2}}}$

11) $y = 3x - 2$

12) $y = 3x - 1$ and $y = 3x + 1$

13)a) $t = 1$ and $t = 3$ **b)** $\frac{4}{3}$ meters backwards

14)a) $p(x) = 3.25 - 0.0005x$ **b)** \$0.55/bar **c)** \$0.25/bar **d)** $p'(x) = 3 - 0.001x$ **e)** \$0/bar

15)a) 0.470 g/m **b)** $f'(4) = 0.516; f'(10) = 0.320$; the confirm that the material of which the wire is composed of is not homogenous.