

M119 Brief Calculus

REVIEW CHAPTERS 0-1

Find an equation of the line containing the pair of points.

- 1) (5, -7) and (0, 4)
- 2) (3, 0) and (-4, 5)

Find the equation of the line in slope-intercept form.

- 3) Through (4, 4), $m = -\frac{8}{9}$
- 4) Through (-4, -1), $m = -3$

Convert to an expression with a rational exponent.

- 5) $\sqrt[11]{t^4}$
- 6) $\frac{1}{\sqrt[3]{a^{11}}}$
- 7) $\frac{1}{\sqrt{x^3 + b}}$
- 8) $\sqrt{(x + 9)^3}$

Convert to an expression using radical notation.

- 9) $\frac{1}{y^{-7/5}}$
- 10) $b^{2/5}$
- 11) $d^{-11/6}$
- 12) $\frac{1}{s^{1/2}}$
- 13) $t^{14/3}$

Find the average rate of change for the function over the given interval.

- 14) $y = 4x^2$ between $x = 0$ to $x = \frac{7}{4}$
- 15) $y = x^3 + x^2 - 8x - 7$ between $x = 0$ and $x = 2$
- 16) $y = \sqrt{2x - 1}$ between $x = 1$ and $x = 5$

Find the instantaneous rate of change when $x = 1$

Find a difference quotient $\frac{f(x+h)-f(x)}{h}$ for the function.

17) $f(x) = x^2 + x$

Find the derivative.

- 18) $f(x) = 4x - 6$
- 19) $f(x) = 2x^2 + 6x - 7$
- 20) $f(x) = 5x^4 - 9x^3 + 6$
- 21) $y = \frac{17}{x^2} + 4x^3 + 10x$
- 22) $f(x) = 9\sqrt[5]{x^7} - 5x^2 + 10^4$
- 23) $y = (4x^2 + 3x)^2$
- 24) $y = (x^2 + 3)^3$

Find the second derivative.

- 25) $y = 7x^3 - 3x^2 + 8$
- 26) $y = (7x - 6)^5$
- 27) $y = \frac{x^4 + 1}{x^2}$

Find $f'(a)$ for the given value of a .

- 28) $f(x) = 4x^{3/2} - 5x^{1/2}$, $a = 16$
- 29) $f(x) = \frac{-8}{x} + \frac{5}{x^2}$, $a = 2$

30) Compute $\frac{d}{dx} (-x^{-5} + x^{-3})|_{x=1}$

- 31) Find the equation of the tangent line to $f(x) = -2x^3 + \frac{1}{x^2}$ when $x = -1$

For the given function, find the points on the graph at which the tangent line has slope 1.

32) $y = \frac{1}{3}x^3 - 6x^2 + x$

- 33) If $f(x) = x^2 + 3x + 1$ and $g(x) = x + 1$ find
a) $f(g(x))$ b) $g(f(x))$

Solve the problem.

- 34) A toilet manufacturer has decided to come out with a new and improved toilet. The fixed cost for the production of this new toilet line is \$16,600 and the variable costs are \$69 per toilet. The company expects to sell the toilets for \$150. Formulate a function $P(x)$ for the total profit from the production and sale of x toilets.
- 35) The profit in dollars from the sale of x thousand compact disc players is
 $P(x) = x^3 - 3x^2 + 3x + 8$. Find the marginal profit when the value of x is 5.
- 36) Find the equation of the tangent line to the curve $y = 3x^2 + 7x - 3$ at the point where $x = 1$.

Given the distance function, $s(t)$, where s is in feet and t is in seconds, find the velocity function, $v(t)$, and the acceleration function, $a(t)$.

- 37) $s(t) = t^2 + 2t - 24$
a) What is the velocity function?
b) What is the acceleration function?
c) What is the velocity at time $t = 2$?
d) What is the acceleration when $t = 2$?
e) At what time is the velocity equal to 30?
- 38) A stone is dropped from a height of 144 feet. Its height at any time t (seconds) is $H(t) = -16t^2 + 144$ feet
a) When will the stone hit the ground?
b) What is the velocity of the stone when it hits the ground?
- 39) A city recreational department plans to build a rectangular playground 3,600 square meters in area. The playground is to be surrounded by a fence. Express the length of the fencing as a function of the length of one of the sides of the playground.
- 40) A closed box with a square base is to have a volume of 1500 cubic inches. Express its surface area as a function of the length of its base.
- 41) A can can hold 12 fluid ounces (approx 6.89π cubic inches). Express the surface area of the can as a function of its radius.

- 42) Since the beginning of the month, a reservoir has been losing water at a constant rate. On the 12th of the month the reservoir held 200 million gallons of water, and on the 21st it held only 164 million gallons.
a) Express the amount of water in the reservoir as a linear function of time.
b) How much water was in the reservoir on the 8th of the month?
- 43) Suppose the cost of producing x units of a particular commodity is $C(x) = 0.04x^2 + 5x + 73$ hundred dollars.
a) Use marginal cost to estimate the cost of producing the sixth unit.
b) What is the actual cost of producing the 6th unit?
c) Use marginal cost to estimate the additional cost if the number of units produced increases from 5 to 5.25,
- 44) Suppose that t years from now the population of a town will be $P(t) = -t^3 + 9t^2 + 48t + 200$ where P is in thousands.
a) At what rate will the population be growing 3 years from now?
b) After how many years will the rate of growth be 63,000?

Answer Key

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- 1) $y = -\frac{11}{5}x + 4$
- 2) $y = -\frac{5}{7}x + \frac{15}{7}$
- 3) $y = -\frac{8}{9}x + \frac{68}{9}$
- 4) $y = -3x - 13$
- 5) $t^4/11$
- 6) $a^{-11/3}$
- 7) $(x^3 + b)^{-1/2}$
- 8) $(x + 9)^{3/2}$
- 9) $\sqrt[5]{y^7}$
- 10) $\sqrt[5]{b^2}$
- 11) $\frac{1}{\sqrt[6]{d^{11}}}$
- 12) $\frac{1}{\sqrt{s}}$
- 13) $\sqrt[3]{t^{14}}$
- 14) 7
- 15) -2
- 16) avg rate of change = $\frac{1}{2}$ instantaneous rate of change = 1
- 17) uu
- 18) 4
- 19) $4x + 6$
- 20) $20x^3 - 27x^2$
- 21) $-34x^{-3} + 12x^2 + 10$
- 22) $\frac{63}{5}x^{2/5} - 10x$
- 23) $64x^3 + 72x^2 + 18x$
- 24) $6x^5 + 36x^3 + 54x$
- 25) $42x - 6$
- 26) $980(7x-6)^3$
- 27) $2 + \frac{6}{x^4}$
- 28) $\frac{187}{8}$
- 29) $\frac{3}{4}$
- 30) 2
- 31) $y = -4x - 1$
- 32) (0, 0) and (12, -276)
- 33) a) $x^2 + 5x + 5$ b) $x^2 + 3x + 2$
- 34) $P(x) = 81x - 16600$
- 35) \$48
- 36) $y = 13x - 6$
- 37) a) $v(t) = 2t + 2$; b) $a(t) = 2$ c) velocity at $t=2$ is 6 d) acceleration at $t = 2$ is 2 e) $t = 14$
- 38) a) 3 seconds b) -96 ft/sec (the negative sign means the stone is coming down at the moment it hits the ground)
- 39) $F = 2w + 7200/w$
- 40) S.A. = $2x^2 + 6000/h$
- 41) S.A. = $2\pi r^2 + \frac{13.78\pi}{r}$
- 42) a) $y = -4t + 248$ b) 216 million gallons
- 43) a) $C'(5) = \$540$ b) $C(6) - C(5) = \$544$
c) $C'(5) \cdot .25 = \$135$
- 44) a) 75,000 people per year b) at $t = 1$ year and $t = 5$ years