

Name: _____

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(1) Find the limits if they exist. If a limit does not exist, explain why.

(a) $\lim_{x \rightarrow -1} \frac{x^2 + 5x + 4}{x^2 + 3x + 2}$

(b) $\lim_{x \rightarrow 0} x \sin \frac{1}{x}$

(c) $\lim_{x \rightarrow 0} \frac{\sin x}{x}$

(2) Give approximations of the following.

(a) $\sin 0.2$

(b) $\cos 0.2$

(c) $\csc 0.2$

(3) Differentiate.

(a) $f(x) = 2x^5 - \pi + \frac{2}{x^5}$

(b) $y = x^7 \sin x$

(c) $y = \ln(x^4 + x + 1)$

(d) $h(x) = \frac{\tan x}{x}$

(e) $m(t) = \sqrt{t^2 + 4}$

(f) $h(t) = t^7 + 7^t$

- (4) Find the equation of the tangent line to the curve $y = x^2 + x + 1$ at $x = 2$.
- (5) It costs \$2 apiece to make tidgets. The number n of tidgets that you can sell is related to the price x by $n = 500 - x$. Your fixed costs are \$200. What price should you charge to maximize your profit?
- (6) The volume of a cone is given by $V = \frac{1}{3}\pi r^2 h$. A conical pile of dinosaur excrement is settling, so the radius and height are changing but the volume is not. Give the formula that relates the rates $\frac{dr}{dt}$ and $\frac{dh}{dt}$ during this process.
- (7) For a young growing dinosaur, the length of the skull S and the length of the backbone B are related by $S = 1.2B^{0.93}$. Give the formula relating the rates of growth of these two parts. (There are two correct ways to write this; choose either.)

(8) Integrate.

(a) $\int_1^2 x + \frac{1}{x} dx =$

(b) $\int_1^5 x\sqrt{x-1} dx =$

(c) $\int x \cos x^2 dx =$

(d) $\int xe^{5x} dx =$

(e) $\int \frac{x+1}{x^2+4} dx =$

(f) $\int \frac{x+1}{x^2-4} dx =$

(9) Solve.

(a) $y' - 5y = 0$, $y(0) = 4$

(b) $y' = 2t(y - 5)$

(10) The population of numbats in Western Australia is given (in millions) by $\frac{dn}{dt} = 0.1n - .02n^2$. In the year 2000 (count this as year zero) the population was 3 million. Find the population in year t . What is the carrying capacity?

