

**Bronx Community College of City University of New York
Department of Mathematics and Computer Science**

MATH 14 REVIEW SHEET

1. Find the center and radius of circle given by $x^2 + y^2 + 6x - 4y = 0$.
2. Identify the curve represented by each equation. Find, where applicable, the center, vertices, foci, radius, and so on.
(a) $4x^2 + 9y^2 + 24x = 0$ (b) $9x^2 - y^2 + 8y - 7 = 0$ (c) $x^2 + 2x - 4y - 3 = 0$
3. Find
(a) $\lim_{x \rightarrow \infty} \frac{3x^2 + 2x + 3}{5x^2 - 8}$ (b) $\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x^2 - 9}$ (c) $\lim_{x \rightarrow -5} \frac{1}{x + 5}$
4. Find $\frac{dy}{dx}$ for $y = \frac{1}{x}$ using the limit process (or the delta method).
5. Find the derivative $\frac{dy}{dx}$ of each function:
(a) $y = 5x^6 - 2x + 1$ (b) $y = 3 \tan 6x$ (c) $y = \ln(3x^2)$ (d) $y = e^{x^2 + 3x}$
(e) $y = \sqrt[3]{4x - 1}$ (f) $y = \arctan 9x$ (g) $y = \frac{2}{x^5} - \frac{1}{x}$ (h) $y = (4x - 7x^2)^5$
(i) $y = 2 \cos^3(4x)$ (j) $y = x^3 \sin \frac{x}{2}$ (k) $y = \frac{\arcsin 2x}{x^2}$ (l) $y = \frac{x}{x^2 - 1}$
(m) $y = e^x \cos x - e^x \sin x$ (n) $y = x\sqrt{1 + 2x}$
6. Find the derivative $\frac{dy}{dx}$ for each equation.
(a) $x = 3t^3; y = 5t - 1$ (b) $xy^2 + 4x^3 - 3y^2 = 8$ (c) $xy + \cot x = 0$.
7. Find the second derivative of $y = \frac{x + 3}{3 - x}$
8. Write an equation of the tangent line and normal to the curve $y = 4x^2 - 5x + 1$ at $x = 2$.
9. A point has horizontal and vertical displacements of $x = 3t^2 + 5t$ and $y = 13 - 3t^2$, respectively.
(a) Find the x and y components of the velocity and acceleration at $t = 40$.
(b) Find the magnitude and direction of the resultant velocity and acceleration in (a).

10. For each function below, find, if any, the x and y intercepts, local maximum and minimum points on the curve, asymptotes, intervals of concave up and down.
- (a) $y = x^3 - 2x^2 - 4x + 8$ (b) $y = \frac{x}{x-1}$ (c) $y = \sqrt{x+1} - x$
11. A spherical balloon is being inflated at the rate of 3 cu.ft/min. At what rate is the balloon's radius increasing at the instant when the radius is 5 ft?
12. A circular plate in a furnace is expanding radially so that its radius is changing 0.01 cm/s. How fast is the area of one face changing when the radius is 5 cm?
13. A plane flying at 2.1 miles above the ground is moving at 450 mph. How fast is it approaching a man on the ground when it is 4 miles from him?
14. An open box is to be constructed from a rectangular sheet of metal 24 cm by 36 cm, by cutting a square from each corner, bending the sides up and welding the seams. Find the length of the side of the square that produces a box of greatest volume.
15. Approximate $\sqrt{26}$ using differentials.
16. Use differentials to approximate the error in area if it is found that error in the measurement of the side of a 10 ft square is 0.1 ft long.

Answer

1. C(-3,2) ; $r = \sqrt{13}$
2. (a) Ellipse : C(-3,0) ; F(-3 $\pm\sqrt{5}$,0); V(0,0), V'(-6,0)
 (b) Hyperbola : C(0,4);V(0,1),V'(0,7) ; F(0, 4 $\pm\sqrt{10}$) (c) Parabola : V(-1,-1) : F(-1,0)
3. (a) 3/5 (b) 5/6 (c) undefined
5. (a) $30x^5 - 2$ (b) $18 \sec^2 6x$ (c) $2/x$ (d) $e^{x^2+3x}(2x+3)$ (e) $4/3(4x-1)^{-2/3}$
 (f) $9/(1+81x^2)$ (g) $-10x^{-6} + x^{-2}$ (h) $5(4x-7x^2)^4(4-14x)$ (i) $-24 \cos^2 4x \sin 4x$
 (j) $\frac{x^3}{2} \cos \frac{x}{2} + 3x^2 \sin \frac{x}{2}$ (k) $(2x/\sqrt{1-4x^2} - 2 \arcsin 2x)/x^3$ (l) $(-x^2-1)/(x^2-1)^2$
 (m) $-2e^x \sin x$ (n) $(3x+1)/\sqrt{2x+1}$
6. (a) $\frac{5}{9}(\frac{x}{3})^{-2/3}$ (b) $\frac{y^2+12x^2}{-2xy+6y}$ (c) $\frac{x \csc^2 x + \cot x}{x^2}$
7. $12/(3-x)^3$
8. Tangent line : $y = 11x - 15$; Normal line : $y = -x/11 + 79/11$
9. (a) $v_x = 245, v_y = -240$ & $a_x = 6, a_y = -6$
 (b) $|v| = 342.965; \theta = -44.409^\circ$ & $|a| = 8.485; \theta = -45^\circ$
10. (a) x -int : $\pm 2, y$ -int : 8; loc. Max $(-\frac{2}{3}, 9\frac{13}{27})$, loc. Min (2,0); conc down $(-\infty, \frac{2}{3})$, conc up $(\frac{2}{3}, +\infty)$
 (b) x -int : 0, y -int : 0; V.A. $x = 1$, H.A. $y = 1$; conc up $(1, +\infty)$, conc down $(-\infty, 1)$
 (c) x -int : $(1 + \sqrt{5})/2, y$ -int : 1; loc. Max $(-\frac{3}{4}, \frac{5}{4})$, loc. Min (-1,1); conc down $[-1, +\infty)$
11. 0.00955 ft/min. 12. 0.314 cm²/s 13. 383 mph 14. 4.708 cm 15. 5.1
16. 2 sq. ft.