

Richard Montgomery High School
Department of Mathematics

Summer Math Packet
for students entering
Multivariable Calculus
in 2009-10

Name: _____

Date: _____

This packet must be completed and ready to turn in to your new math teacher on the **first day of school**. It will be graded and you will be tested on the material in this packet within the first few weeks of school.

Try to wait until late July or early August to begin working on this packet. We want to make sure the material is fresh in your mind.

You may work with a classmate or a peer. You may use textbooks or other sources to help you complete the packet, however, each student must submit their own packet, and each student is responsible for understanding the material contained in the packet. Graphing calculators are allowed. Make sure to show an appropriate amount of work. All work, including answers, are to be completed on separate paper. Please attach your work to the back of the packet.

1. Use Cramer's rule to solve the system of equations.

$$x + 2z = 6$$

$$-3x + 4y + 6z = 30$$

$$-x - 2y + 3z = 8$$

2. Give polar coordinates for the following points.

a. $(-2,2)$ b. $(5,0)$ c. $(3, -3\sqrt{3})$

d. $(-4,-4)$ e. $(0,-3)$ f. $(0,1)$

3. Find the four fourth roots of -16. Express answers in exact form (no decimals).

4. Find an equation of the plane through the points P(1,2,-1), Q(2,3,1), and R(3,-1,2).

5. The vector, $(3,4,-2)$ is perpendicular to a plane at the point $(0,1,2)$. Find an equation of the plane.

6. Given the points A(2,2,2) and B(4,6,8), find an equation of the plane perpendicular to line segment AB at its midpoint.

7. Express the given series using sigma notation.

a. $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \dots$

b. $48 + 24 + 12 + 6 + \dots$

8. Express $\sum_{k=3}^7 5^{k-2}$ in sigma notation so that the lower limit of summation is 0 rather than 3.

9. Express $\sum_{k=4}^8 k(k-3)$ in sigma notation so that the lower limit of summation is 1 rather than 4.

10. Locate the relative extrema of $f(x) = x^3 - 3x^2 + 3x - 1$.

11. Let $y = \sqrt{x}$. Find dy and Δy if $x = 4$ and $dx = \Delta x = 3$. Then, make a sketch of $y = \sqrt{x}$ showing dy and Δy in the picture.

12. Use implicit differentiation to find $\frac{dy}{dx}$ if $5y^2 + \sin y = x^2$.

13. Find the slope of the tangent line at $(4,0)$ to the graph of $7y^4 + x^3y + x = 4$.

14. Use implicit differentiation to find $\frac{d^2y}{dx^2}$ if $4x^2 - 2y^2 = 9$.

In #15-22, evaluate using u-substitution.

15. $\int 3x^2 \sqrt{x^3 + 1} dx$

16. $\int \frac{dx}{(\frac{1}{3}x - 8)^5}$

17. $\int (x + \sec^2 \pi x) dx$

18. $\int x^4 \sqrt[3]{3 - 5x^2} dx$

19. $\int \frac{x^2 dx}{\sqrt{x^3 + 1}}$

20. $\int 3x^2 \sqrt{x^3 + 1} dx$

21. $\int_{-1}^1 \frac{x^2 dx}{\sqrt{x^3 + 9}}$

22. $\int_{-1}^0 6x^2(x^3 + 1)^{19} dx$

23. Find the area of the region enclosed between the curves $y = x^2$ and $y = x + 6$.

24. Find the area of the region bounded above by $y = x + 6$, bounded below by $y = x^2$, and bounded on the sides by the lines $x = 0$ and $x = 2$.

25. Find the area of the region enclosed by the curves $y = \sqrt{x}$, $y = -x + 6$ and $y = 1$.

In #26-28, evaluate using integration by parts.

26. $\int xe^x dx$

27. $\int x^2 e^{-x} dx$

28. $\int e^x \cos x dx$

In #29-30, evaluate using partial fractions.

29. $\int \frac{dx}{x^2 + x - 2}$

30. $\int \frac{x^2 + x - 2}{3x^3 - x^2 + 3x - 1} dx$