Richard Montgomery High School
Department of Mathematics

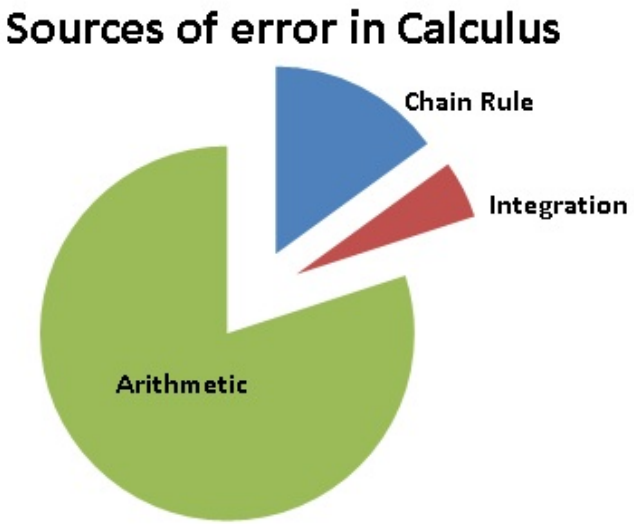
Summer Math Packet

for students entering

AB Calculus, IB SL Math or BC Calculus

Name: _____ Date: _____

The problems in the packet are designed to help you review topics from Algebra 2 and Pre-Calculus that are important to your success in AP Calculus.
*If you are going into **AB** Calculus or **IBSL** Math, complete problems #1 → 15.*
*If you are going into **BC** Calculus, complete problems #1 → 23.*



Please attempt the problems on your own without any notes and SHOW ALL WORK! In addition, **do not use your calculator for these problems**. When you come across topics that require a little review, feel free to look at your old notes, search a website or ask a friend for help. If you want to check your work with a calculator, that is fine also.

Bring the finished packet with you to your Calculus class on the first day of school. You will be assessed on these skills during the first week of school as part of your 1st quarter grade.

Enjoy your summer! We are looking forward to seeing you in August. If you have any questions, please contact the math Resource Teacher: Laura_D_Goetz@mcpsmd.org

Review problems for AB/BC

1. Simplify.

(a) $\frac{x-4}{x^2-3x-4}$ (b) $\frac{x^2-4x-32}{x^2-16}$ (c) $\frac{(5-x)}{x^2-25}$

2. Simplify the expression, writing answers with positive exponents where applicable.

(a) $\frac{1}{x+h}-\frac{1}{x}$ (b) $\frac{\left(\frac{2}{x^2}\right)}{\left(\frac{10}{x^5}\right)}$

(c) $\frac{12x^{-3}y^2}{18xy^{-1}}$ (d) $\frac{15x^2}{5\sqrt{x}}$

(e) $(5a^3)(4a^2)$ (f) $\left(4a^{5/3}\right)^{3/2}$

(g) $\frac{\frac{1}{2}-\frac{5}{4}}{\frac{3}{8}}$

Review problems for AB/BC

3. Simplify.

(a) $\log_2 8$ (b) $\log\left(\frac{1}{100}\right)$ (c) $\ln e^7$

(d) $27^{2/3}$ (e) $\ln 1$ (f) e^0

4. Solve for z.

(a) $4x + 10yz - 3 = 0$ (b) $y^2 + 3yz - 8z - 4x = 0$

5. Given $f(x) = \frac{x}{x+3}$, $g(x) = \sqrt{x-3}$, and $h(x) = x^2 + 5$, find

(a) $h\big(g(x)\big)$ (b) $(f \circ h)(-2)$

(c) $f\big(f(3)\big)$ (d) $g^{-1}(x)$

Review problems for AB/BC

6. Use either the slope-intercept or point-slope form of a line to write the equation for the line given the constraints.

   (a) with slope -2 containing the point $(3,4)$

   (b) containing the points $(1,-3)$ and $(-5,2)$

   (c) with slope 0 containing the point $(4,2)$

   (d) parallel to the line $2x-3y=7$ containing the point $(5,1)$

   (e) perpendicular to the line $-3y+6x=2$ containing the point $(4,3)$

7. Let f be a linear function with $f(2)=-5$ and $f(-3)=1$. State the function $f(x)$.

8. Find the distance between the points $(8,-1)$ and $(-4,-6)$.

9. Without a calculator, determine the exact value of the expression.

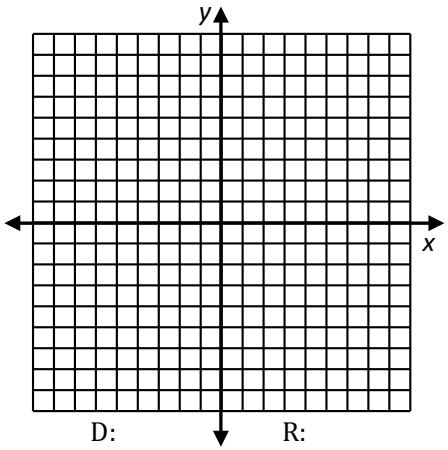
   (a) $\sin\frac{\pi}{2}$ (b) $\sin\frac{3\pi}{4}$ (c) $\cos\pi$ (d) $\cos\frac{7\pi}{6}$

   (e) $\cos\frac{\pi}{3}$ (f) $\tan\frac{7\pi}{4}$ (g) $\tan\frac{2\pi}{3}$ (h) $\tan\frac{\pi}{2}$

Review problems for AB/BC

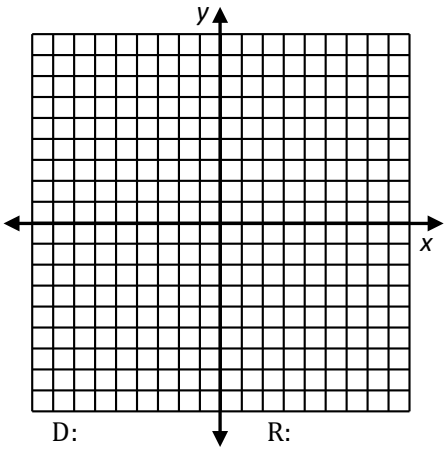
10. For each function, make a neat sketch, including a scale or numbering of the axes. Name the domain and range for each as well. (Remember, no calculator!)

(a) $y = \sqrt{x}$



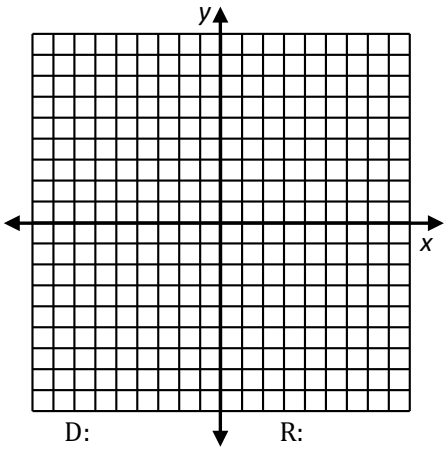
D: R:

(b) $y = \sqrt[3]{x}$



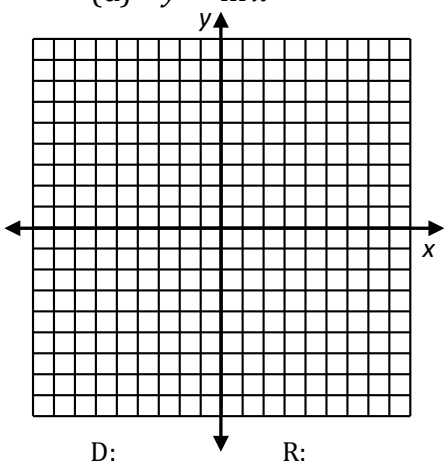
D: R:

(c) $y = e^x$



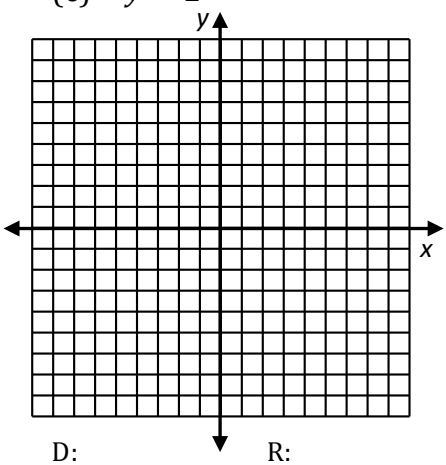
D: R:

(d) $y = \ln x$



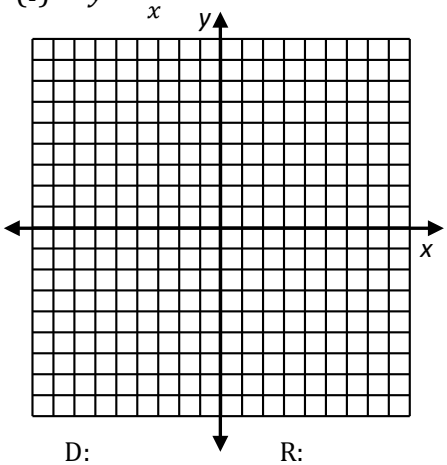
D: R:

(e) $y = 2^x$



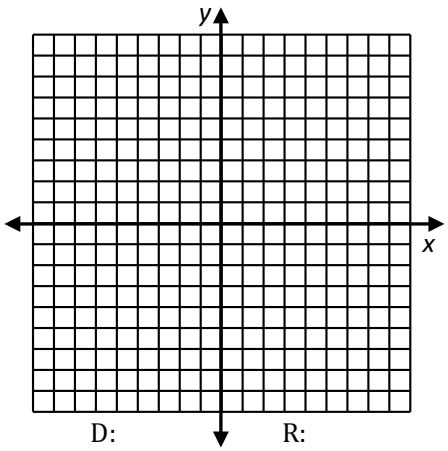
D: R:

(f) $y = \frac{1}{x}$



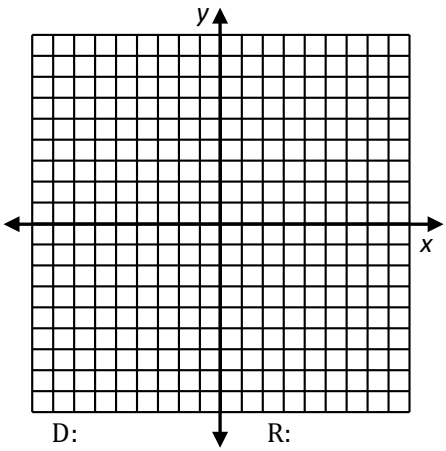
D: R:

(g) $y = x^2 - 4$



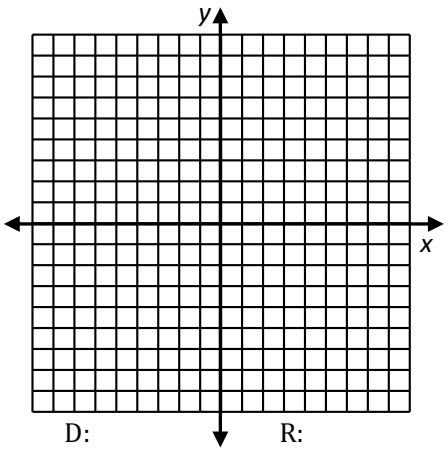
D: R:

(h) $y = x^2 + 4x + 3$



D: R:

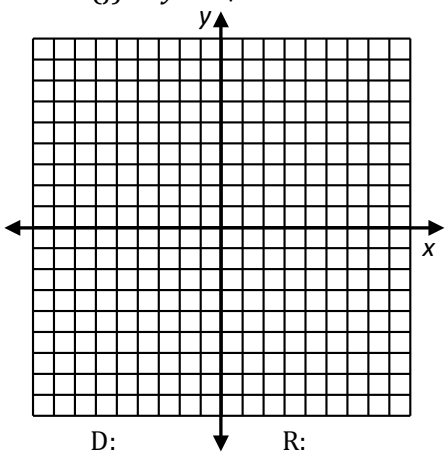
(i) $y = \sin x$



D: R:

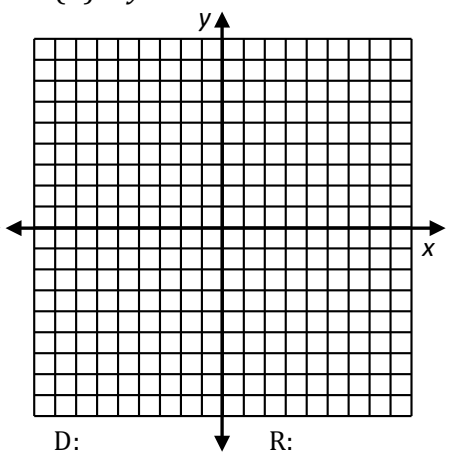
Review problems for AB/BC

(j) $y = \sqrt{x-2}$



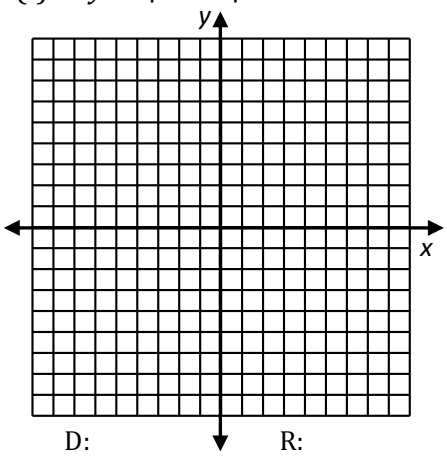
D: R:

(k) $y = \sqrt{4-x^2}$



D: R:

(l) $y = |x+3| - 2$

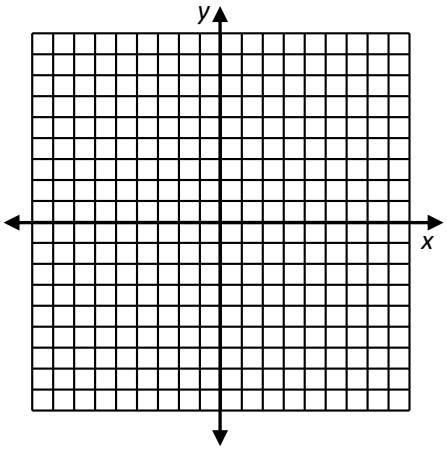


D: R:

11. Identify the vertical and horizontal asymptotes in the graph of $y = \frac{3x^2+5}{x^2-4}$.

12. Sketch the graph of the piecewise-defined function.

$$f(x) = \begin{cases} x^2 - 5, & x < -1 \\ 0, & x = -1 \\ 3 - 2x, & x > -1 \end{cases}$$



13. Determine all points of intersection (Remember, no calculator!).

(a) $y = x^2 + 3x - 4$ and $y = 5x + 11$

(b) $y = \cos x$ and $y = \sin x$ on the interval $[0, \pi]$.

Review problems for AB/BC

14. Solve for all x, where x is a real number (remember, no calculator!).

(a) $x^2 + 3x - 4 = 14$

(b) $2x^2 + 5x = 3$

(c) $(x-5)^2 = 9$

(d) $(x+3)(x-3) > 0$

(e) $\log x + \log(x-3) = 1$

(f) $|x-3| < 7$

(g) $3\sqrt{x-2} - 8 = 8$

(h) $12x^2 = 3x$

(i) $27^{2x} = 9^{x-3}$

(j) $4e^{2x} = 12$

15. Use trigonometric identities to simplify the expression.

(a) $\sin^2 x + \cos^2 x$

(b) $1 + \tan^2 x$

(c) $\cot^2 x + 1$

(d) $\sin 2x$

(e) $\cos 2x$

Review for AB Calculus is complete

Review problems for BC only

16. Eliminate the parameter.

$$\begin{cases} x = t^2 - 3 \\ y = 2t \end{cases}$$

17. Expand and simplify.

(a) $\sum_{n=2}^{5} 3n - 6$

(b) $\sum_{n=0}^{4} \frac{(n+1)^2}{n!}$

18. Write the series in summation notation (notice that (a) is infinite and (b) is finite).

(a) $\frac{1}{4} + \frac{3}{4^2} + \frac{5}{4^3} + \cdots$

(b) $\frac{1}{2^3-1} - \frac{1}{3^3-2} + \frac{1}{4^3-3} - \cdots + \frac{1}{10^3-9}$

19. Say if the series converges or diverges. Explain why, and give the sum if possible.

(a) $\sum_{n=0}^{\infty} \left(\frac{3}{2}\right)^n$

(b) $\sum_{n=0}^{\infty} \frac{1}{n^4+1}$

(c) $\sum_{n=1}^{\infty} \frac{(n-1)(n^2+7)}{n^3+2}$

(d) $\frac{1}{7} - \frac{3}{7^2} + \frac{3^2}{7^3} - \frac{3^3}{7^4} + \cdots$

20. Given the vectors $\vec{v} = -2\vec{\imath} + 5\vec{\jmath}$ and $\vec{w} = 3\vec{\imath} + 4\vec{\jmath}$, compute

(a) $\frac{1}{2}\vec{v}$ (b) $\vec{w} - \vec{v}$ (c) $|\vec{w}|$

(d) magnitude of $\vec{v}$. (e) $\vec{w} \cdot \vec{v}$

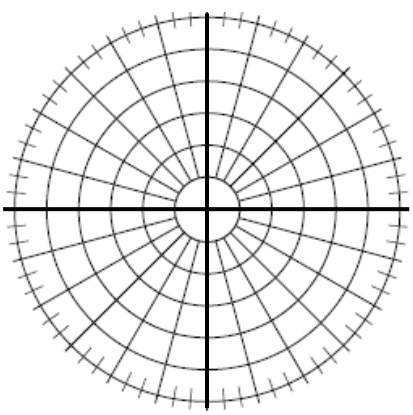
21. Perform the following polar conversions.

(a) Convert $(4,4)$ to polar coordinates.

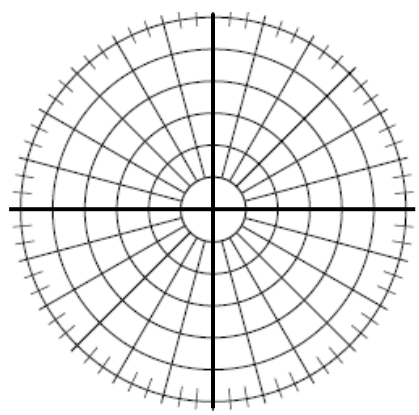
(b) Convert $\left(2, \frac{\pi}{6}\right)$ to rectangular coordinates.

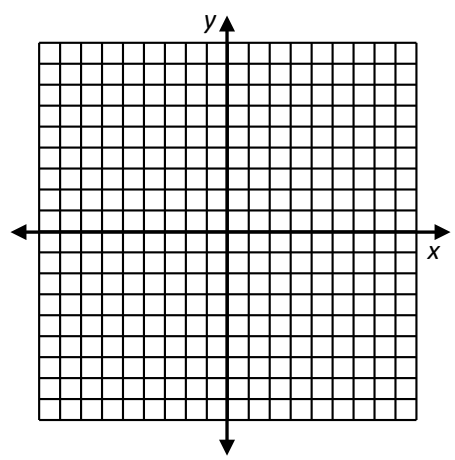
22. Graph the polar functions.

(a) $r = 1 - 3\cos\theta$



(b) $r = 4\sin 3\theta$



23. Graph the parametric equations for $0 \le t \le 3$.

$$\begin{cases} x = 2t - 1 \\ y = 3t - 5 \end{cases}$$