Calc 3 Summer Packet

In order to be prepared to start Calc 3 in August, you will be doing some work over the summer in three areas:

1. Reviewing differentiation and integration techniques to keep those skills sharp

2. Learning to graph in 3D and visualize mathematical objects in 3D

3. Extending both our work on vectors and your prior study of geometry to 3 dimensions

The problems over the first two topics are included in this packet. The work for the third topic will come from completing some textbook problems from Chapter 11 and Chapter 12 so please get a textbook from the bookstore. The problems to be completed are listed below. You will essentially be doing sections 11.1, 11.2, 12.1, 12.2, and 12.3 from the Calc 3 book on your own, as they all cover concepts with which you are familiar simply being extended to 3 dimensions. In order to help you through that material, I have uploaded the Calc 3 notes for each of those sections onto a Google classroom (see below).

You should do this packet first and then the book problems.

We will go over questions on the summer assignment on the first day of school and then move forward in Chapter 11 and Chapter 12.

Textbook problems:

11.1 pg 759, #9, 27, 35, 51, 61, 77

11.2 pg 767, #5, 7, 9, 25, 31, 33, 37, 43, 47, 49, 51, 57, 63, 71, 83, 94

12.1 pg 825, #3, 17, 19, 21, 23, 31, 33, 37, 43, 45, 65, 67, 69, 73, 75, 82

12.2 pg 834, #9, 13, 15, 17, 23 (skip part d), 27, 31, 35 (skip part e), 39, 41, 43, 45, 47, 49, 51, 57

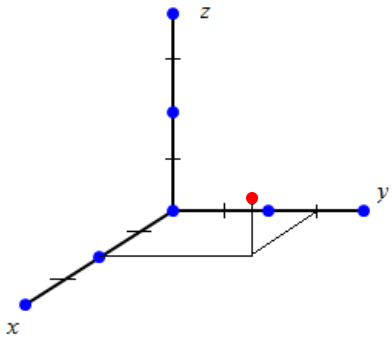
12.3 pg 842, #11, 13, 23, 27

[I have only assigned odds so that you can use Calc Chat for help if you need it.]

Google Classroom code: ml5vaj2

3-Dimensional Geometry

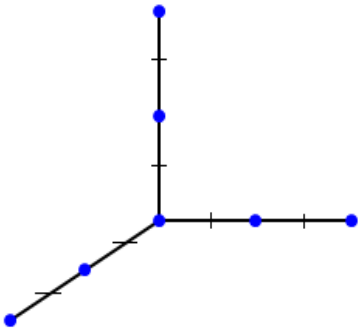
The study of Vector Calculus (Calculus III) requires a strong ability to visualize functions in three dimensions. In order to identify the location of individual points (x, y, z) in the xyz coordinate system, we sometimes use parallelograms as follows:



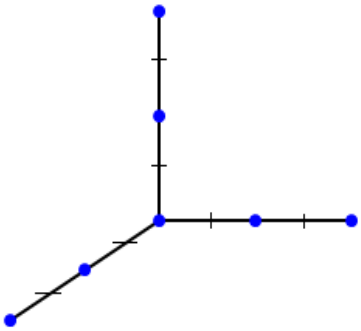
This is one way to visualize the location of the point (2, 3, 1). Imagine that the x and y axes are flat on the paper and that the z-axis is coming straight up off the desk.

Plot the given point on the 3D coordinate system. First label the axes like the diagram above. You may want to also try graphing these on the 3D graph paper.

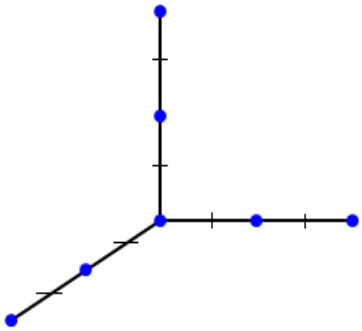
1. (3, 1, 2)



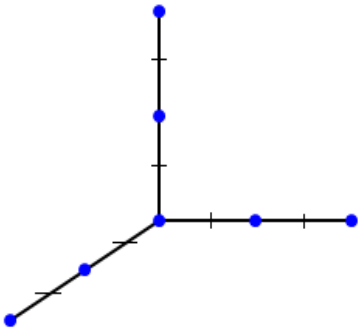
2. (2, -2, 2)

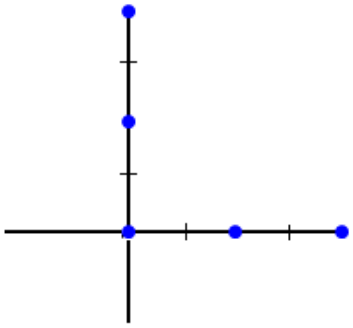


3. (-1, 3, -2)



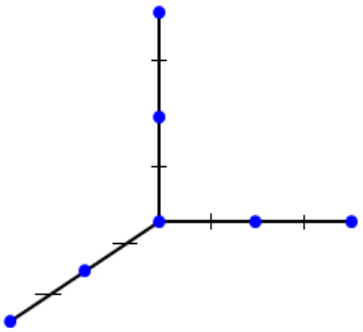
4. (a) Plot the two points (0, 4, 0) and (2, 0, 0) on the diagram below and connect the dots with a straight line. Then use Algebra I techniques to write the equation of the line in slope-intercept form. (b) Also sketch the graph of the line in the regular 2D xy-plane. Notice how the graph in the 3D system can be thought of as a rotation of the graph in the 2D plane.



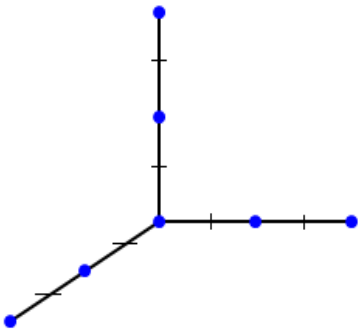


Sketch in the *xy*-plane the graphs of the indicated functions. You may want to visualize the graph in the 2D *xy*-plane first.

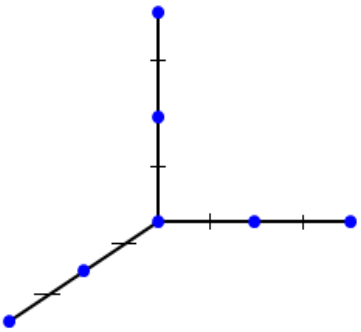
5. $y = 3x$



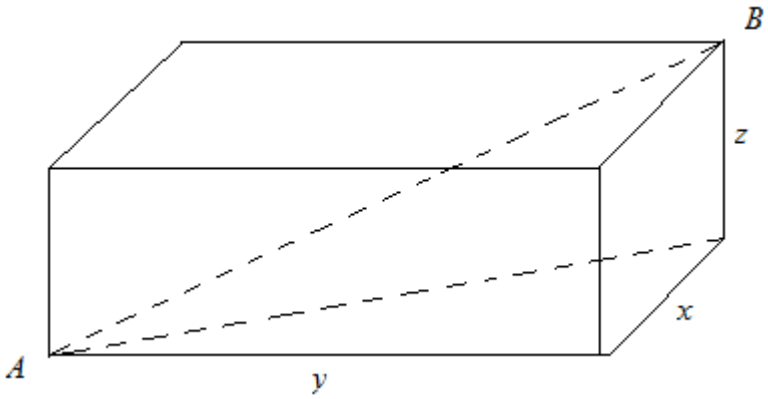
6. $y = x^2$



7. $y = 2\cos x$



8. The box below has unknown length *y*, width *x*, and height *z*. Determine a formula for the length of segment *AB*. (Hint: Use the Pythagorean Theorem twice).



Differentiation/Integration

Find the second derivative of the function.

9. $f(x) = 4x^{3/2}$

10. $g(x) = \dfrac{e^x}{x}$

11. Find $f'(2)$ for the functions below given the following: g(2) = 3, g'(2) = -2, h(2) = -1, h'(2) = 4

a) $f(x) = 2g(x) - h(x)$

b) $f(x) = g(h(x))$

c) $f(x) = \frac{g(x)}{h(x)}$

d) $f(x) = g(x)h(x)$

For 12 – 20, find the derivative of the function.

12. $y = \sqrt[3]{9x^2 + 4}$

13. $y = \dfrac{1}{x-2}$

14. $y = x\sqrt{1-x^2}$

15. $y = \cos 3x$

16. $f(\theta) = \dfrac{1}{4}\sin^2 2\theta$

16. $y = \sin(\cos x)$

18. $y = e^{\sqrt{x}}$

19. $y = \ln(e^{x^2})$

20. $f(x) = \ln\left(\dfrac{x}{x^2+1}\right)$

For 21 – 30, find the indicated integrals. You may have to use basic rules, u-substitution, by-parts, partial fractions, or trig-substitution.

21. $\int_0^{\pi/2} e^{\sin x}\cos x \; dx$

22. $\int_{-2}^{2} \sqrt{4-x^2} \; dx$ (using geometry)

23. $\int_1^3 \sqrt{x}\ln x \; dx$

24. $\int x^2 e^x dx$

25. $\int \sin^{10}(x)\cos^3(x) \; dx$

26. $\int_1^2 \dfrac{3}{x\sqrt{x^2-1}} dx$

27. $\int_1^2 \dfrac{x+7}{x^2-x-6} dx$

28. $\int \dfrac{1}{\sqrt{x^2+9}} dx$

29. $\int \dfrac{x^3+3x^2+1}{x^2+4} dx$

30. $\int 3^{5x} dx$