MATH1505.com

We Make Math Easy.

Chapter 5.5

Tutorial Length
1 Hr

Homework ~ Tutorials ~ Past Tests

Important

Math 1505 is a HUGE course. Many students fear the course, but you don't need to, you've got us! The keys to success are to practice as many types of problems as possible and not to fall behind. Each chapter builds on the concepts of a previous chapter so it's crucial to understand the material from one chapter before moving on.

This is where MATH1505.COM comes in. We have developed extensive tutorial videos for each section that will give you a quick overview of the theory before we jump in to examples. Our goal is to make things as simple as possible. We will go through MANY examples in order to ensure you understand the concept. We want to show that one concept can be tested in multiple different ways. By making your way through all the questions, you will see different variations and learn new techniques that will make MATH 1505 a breeze. We'll show you shortcuts, easy tricks to remember, and even go through past test questions.

In short, if you're reading this, you're already on the right path. Your success is our success and we wish you the best with this course.

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Helpful Tips

- **Each question has a 4 digit video ID code. If you only want to watch a specific example, just search for the 4 digit code in the playlists.**
- **Some sections are very long. Consider breaking it down into smaller periods of time (1 hour chunks) in order to efficiently absorb the information.**
- **When going through tutorial videos, if you are having a particularly difficult time with a question, skip it and come back later. Sometimes the brain just needs a bit of a break!**
- **Keep all of your MATH1505.com booklets in a binder. This way when it's time to do a final review for a test, you can quickly go through the material. Try to circle or highlight key points. These items will stand out when you begin reviewing.**
- **If you've purchased access to past tests, don't go through those questions until you feel you've learned all the material. Then go through as many past tests as possible in preparation for your actual test. Once you go through the solutions, you will see where you still have issues and what you still need to review.**

Policy Reminder:

While sharing is caring, any user accounts found to be shared between students will be terminated with no refunds. Additionally, access to all premium content will expire after the final exam. If you have a deffered exam, please e-mail within 14 days of the final exam to make arrangements for extended access.

Contact

Questions, Concerns, Comments? info@math1505.com
Please note we are unable to offer tutoring assistance over e-mail.

Integration By Parts [VID_4942]

This is a lot like the product rule but for integrals. We usually (but not always) apply this technique when two functions are being multiplied. The formula is given by:

$$\int udv = uv - \int vdu \quad [Indefinite] \qquad \int_{\boldsymbol{a}}^{\boldsymbol{b}} udv = uv\Big|_a^b - \int_{\boldsymbol{a}}^{\boldsymbol{b}} vdu \quad [definite]$$

How do I choose *u* and *dv*? In general, you choose a *u* such that its derivative *du* is considered simpler. Then, to find du, take the derivative of u, and to find v, take the integral (antiderivative) of dv.

Helpful Hint 1:

LIATE: *u* is typically the first term from this list. This works in **most** situations.

*L*ogarithm $(lnx, \log_5 x, \text{etc})$
*I*nverse Trig $(arctanx, arcsinx, \tan^{-1} x\,, etc)$
*A*lgebraic (polynomial) $(2x+1,\ x^2+5x-9, \sqrt{x^2+2}\ \ etc)$
*T*rig $(sinx, cosx, cotx, secx, etc)$
*E*xponential $(2^x, e^x, etc)$

Helpful Hint 2:

Based on the selection of dv, if you can't integrate in order to find v, then either the wrong term was selected as dv OR integration by parts is not possible and another integration technique must be used.

Note:
Just because there is a product in the integral, it does not mean it's automatically integration by parts, it could be an integral that can be completed by U-Substitution. Similarly, just because you don't see a product doesn't mean it can't be integration by parts. This is because there is always an invisible multiplication by 1 which can be used to answer some questions.

Example [VID_0833]

$$\int xe^x dx \qquad \int_0^1 xe^x dx$$

Integration By Parts Formula:

$$\int udv = uv - \int vdu$$

Example [VID_6689]

$$\int (4x + 2)e^x dx$$

Example [VID_2024]

$$\int \frac{8x}{e^{5x}} dx$$

Integration By Parts Formula:

$$\int udv = uv - \int vdu$$

Example [VID_0093]

$$\int (x^2 + 2x)\, sin\, x\, dx$$

Integration By Parts Formula:

$$\int udv = uv - \int vdu$$

Example [VID_4417]

$$\int 2x^4 lnxdx$$

Example [VID_6112]

$$\int_1^e lnxdx$$

Integration By Parts Formula:

$$\int udv = uv - \int vdu$$

Whenever there is an **exponential and trig** function when doing integration by parts, you will most likely encounter a 'repeating integral' situation. In this case, when you see your original integral show up, bring it to the other side of the equation and then divide by the coefficient to solve.

Example [VID_0036]

$$\int e^x sinxdx$$

Integration By Parts Formula:

$$\int udv = uv - \int vdu$$

Whenever there is an **exponential and trig** function when doing integration by parts, you will most likely encounter a 'repeating integral' situation. In this case, when you see your original integral show up, bring it to the other side of the equation and then divide by the coefficient to solve.

Example [VID_6203]

$$\int e^{3x} cos4x dx$$

Combining Techniques

Sometimes integral questions will involve combining multiple techniques in order to get to a solution.

Example [VID_7095]

$$\int arctanxdx$$

Solution

$$= uv - \int vdu \qquad u = arctanx \qquad dv = 1dx$$

$$du = \frac{1}{1+x^2}dx \qquad v = x$$

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

$$= xarctanx - \int \frac{x}{1+x^2}dx$$

$$= xarctanx - \int \frac{x}{u_1}\frac{du_1}{2x} \qquad u_1 = 1+x^2$$

$$dx = \frac{du_1}{2x}$$

$$= xarctanx - \int \frac{1}{2u_1}du_1$$

$$= xarctanx - \frac{1}{2}\int \frac{1}{u_1}du_1$$

$$= xarctanx - \frac{1}{2}ln|u_1| + C$$

$$= xarctanx - \frac{1}{2}ln|1+x^2| + C$$

Combining Techniques

Sometimes integral questions will involve combining multiple techniques in order to get to a solution.

Example [VID_5390]

$$\int x^3 \cos(x^2)\, dx$$