# Section 5.2: Placeholder

## Introduction:

Filler text

## Subsection 5.2.1: Factoring Difference of Cubes

### Introduction

The difference of cubes formula is used for factoring polynomials of the form

The difference of cubes formula is given by

|  |  |  |
| --- | --- | --- |
|  |  |  |

To use the difference of cubes formula to factor

we need to find .

Since we are trying to factor

we want to replace with to match the difference of cubes formula .

|  |  |  |
| --- | --- | --- |
|  |  |  |

This means that

|  |  |  |
| --- | --- | --- |
|  |  |  |

Therefore, we factor with the following steps:

1. Find by solving .
2. Substitute the value of into the difference of cubes formula to get

### Example 5.2.1.1:

|  |  |
| --- | --- |
| In General | Specific |
| Factor: | |
|  |  |
| **Step 1:** | |
| **Step 1.1:** Solve for Reference: Solving Equations | |
| Find by solving |  |
| **Step 2:** | |
| **Step 2.1:** Substitute into the difference of cubes formula Reference: Substituting Into Equations | |
|  |  |

What is the answer?

## Subsection 5.2.2: Compute Limits of Fractions of Polynomials

### Introduction

In Substituting Into Limits (Section 5.1.1), we saw that the first step in calculating

is to plug in for .

In this section, we will discuss how to find

However, sometimes we get division by 0 when plugging in .

There are three possible outputs when plugging in into the limit:

|  |  |
| --- | --- |
| Cases | Examples |
| **Case 1:** |  |
| **Case 2:** |  |
| **Case 3:** |  |

In Case 1, the problem is always solved (there is nothing left to do after plugging in).

In Case 1, the answer is always 0 or a non-zero number.

In the example of Case 1 in the above table, the answer was .

An example of Case 1 with a non-zero number is below:

In the second case, we need to get rid of the division by .

We do this by factoring the numerator and denominator and cancelling the common factor.

We will discuss the third case in Placeholder Name (Section placeholder).

### Example 5.2.2.2.1:

|  |  |
| --- | --- |
| In General | Specific |
| Find: | |
|  |  |
| **Step 1:** | |
| **Step 1.1:** Try to substitute for Reference: Substituting Into Limits | |
|  |  |

There are three cases following step 1 when computing limits by fractions of polynomials.

|  |  |
| --- | --- |
| **Case 1:**  No factoring needed, because the problem is complete. |  |
| **Case 2:**  Factor the numerator and denominator and cancel the common factor. |  |
| **Case 3:**  Try factoring, then consider one-sided limits. |  |

Which Case Applies?

**Case 2:** Factor the numerator and denominator and cancel the common factor.

|  |  |
| --- | --- |
| **Step 2** | |
| **Step 2.1:** Identify Polynomials | |
| Polynomial 1 |  |
| Polynomial 2 |  |
|  |  |
| **Step 2.2:** Factor Polynomials | |
| Polynomial 1: | |
| Identify Factoring Case:  Difference of Cubes | Reference: Factoring Polynomials |
| We want to factor | |
|  |  |
|  |  |
| **Step 2.2.1:** Solve for Reference: Solving Equations | |
|  |  |
| **Step 2.2.2:** Substitute into difference of cubes formula Reference: Substituting Into Equations | |
|  |  |
| Polynomial 2 | |
| Identify Factoring Case: Reference: Factoring Polynomials  Cannot factor b/c linear with no greatest common factor | |
| **Step 2.3:** Substitute factored polynomials into limit Reference: Substituting Into Equations | |
| In General:  Specific: | |
| **Step 3:** | |
| **Step 3.1:** Cancel common factors Reference: Cancelling Common Factors | |
| In General:  Specific: | |
|  |  |
| **Step 4:** | |
| **Step 4.1:** Try to substitute for Reference: Substituting Into Limits | |
|  |  |

There are two cases following step 4 in Case 1 when computing limits of fractions of polynomials.

|  |  |
| --- | --- |
| **Case 1:**  No factoring needed because problem is complete. |  |
| **Case 2:**  (No longer applies) |  |
| **Case 3:**  Since the problem is already factored consider one-sided limits |  |

Which Case Applies?

**Case 1:** No factored needed because problem is complete.

What is the answer?