#include <stdio.h>

#include <math.h>

#include <string.h>

#include <stdlib.h>

void differentiate\_polynomial(double a, int n) {

if (n == 0) {

printf("d/dx(%.2lf) = 0\n", a);

} else {

printf("d/dx(%.2lf \* x^%d) = %.2lf \* x^%d\n", a \* n, n - 1);

}

}

void integrate\_polynomial(double a, int n) {

if (n == -1) {

printf("∫ %.2lf \* x^%d dx = %.2lf \* ln(x) + C\n", a, n);

} else {

printf("∫ %.2lf \* x^%d dx = %.2lf \* x^%d / (%d+1) + C\n", a, n, a / (n + 1), n);

}

}

void differentiate\_exponential() {

printf("d/dx(e^x) = e^x\n");

}

void integrate\_exponential() {

printf("∫ e^x dx = e^x + C\n");

}

void differentiate\_sine() {

printf("d/dx(sin(x)) = cos(x)\n");

}

void integrate\_sine() {

printf("∫ sin(x) dx = -cos(x) + C\n");

}

void differentiate\_cosine() {

printf("d/dx(cos(x)) = -sin(x)\n");

}

void integrate\_cosine() {

printf("∫ cos(x) dx = sin(x) + C\n");

}

void differentiate\_tangent() {

printf("d/dx(tan(x)) = sec^2(x)\n");

}

void integrate\_tangent() {

printf("∫ tan(x) dx = -ln(cos(x)) + C\n");

}

void differentiate\_sum(double a1, int n1, double a2, int n2) {

differentiate\_polynomial(a1, n1);

differentiate\_polynomial(a2, n2);

}

void integrate\_sum(double a1, int n1, double a2, int n2) {

integrate\_polynomial(a1, n1);

integrate\_polynomial(a2, n2);

}

void handle\_expression(char \*expression) {

if (strstr(expression, "sin") != NULL) {

if (strstr(expression, "d/dx") != NULL) {

differentiate\_sine();

} else {

integrate\_sine();

}

} else if (strstr(expression, "cos") != NULL) {

if (strstr(expression, "d/dx") != NULL) {

differentiate\_cosine();

} else {

integrate\_cosine();

}

} else if (strstr(expression, "tan") != NULL) {

if (strstr(expression, "d/dx") != NULL) {

differentiate\_tangent();

} else {

integrate\_tangent();

}

} else if (strstr(expression, "x") != NULL)

double a;

int n;

sscanf(expression, "%lf \* x^%d", &a, &n);

if (strstr(expression, "d/dx") != NULL) {

differentiate\_polynomial(a, n);

} else {

integrate\_polynomial(a, n);

}

} else {

printf("Unknown expression: %s\n", expression);

}

}

int main() {

int choice;

char expression[100];

printf("Complex Calculator for Differentiation and Integration\n");

while (1) {

printf("\nSelect operation:\n");

printf("1. Differentiate a polynomial ax^n\n");

printf("2. Integrate a polynomial ax^n\n");

printf("3. Differentiate sin(x)\n");

printf("4. Integrate sin(x)\n");

printf("5. Differentiate cos(x)\n");

printf("6. Integrate cos(x)\n");

printf("7. Differentiate tan(x)\n");

printf("8. Integrate tan(x)\n");

printf("9. Handle general expression (e.g., ax^n + sin(x))\n");

printf("10. Exit\n");

printf("Enter your choice: ");

scanf("%d", &choice);

getchar();

switch (choice) {

case 1:

printf("Enter the coefficient (a) and exponent (n) for ax^n: ");

double a;

int n;

scanf("%lf %d", &a, &n);

differentiate\_polynomial(a, n);

break;

case 2:

printf("Enter the coefficient (a) and exponent (n) for ax^n: ");

scanf("%lf %d", &a, &n);

integrate\_polynomial(a, n);

break;

case 3:

differentiate\_sine();

break;

case 4:

integrate\_sine();

break;

case 5:

differentiate\_cosine();

break;

case 6:

integrate\_cosine();

break;

case 7:

differentiate\_tangent();

break;

case 8:

integrate\_tangent();

break;

case 9:

printf("Enter the expression for differentiation or integration (e.g., ax^n, sin(x), etc.): ");

fgets(expression, sizeof(expression), stdin);

handle\_expression(expression);

break;

case 10:

printf("Exiting the program.\n");

return 0;

default:

printf("Invalid choice. Please try again.\n");

}

}

return 0;

}