AN_Nov04

Question 1: Write functions sine(x), cosine(x), tagent(x). Write also a main program wchich will call functions to get sin(x), cos(x) and tan(x). Use the Taylor series expansion of sin(x), cos(x).

1. function_sine.sql
2. function_cos.sql
3. function_tangent.sql
4. sin_cos_tan_main.sql

$$sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

$$cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots$$

$$tan(x) = \frac{sin(x)}{cos(x)}$$

The sine function is:

```
--function_sine.sql: Write a function to calculate sin(x) using Taylor series
expansion.



CREATE OR REPLACE FUNCTION SINE(

    X IN NUMBER

) RETURN NUMBER AS

    CSIN NUMBER;

    FACT NUMBER;

    N    NUMBER;

    TERM NUMBER;

    EPS  NUMBER;

    XRAD NUMBER;

    I    NUMBER;
```

```
    SF   NUMBER;
BEGIN
    XRAD := X*3.141592653589793/180;
    CSIN := XRAD;
    EPS := CSIN;
    IF(EPS < 0) THEN
        EPS := -EPS;
    END IF;
    N := 3;
    SF := -1;
    WHILE(EPS > 1e-12) LOOP
        FACT := 1;
        FOR I IN 1..N LOOP
            FACT := FACT*I;
        END LOOP;
        TERM := SF*XRAD**N/FACT;
        CSIN := CSIN + TERM;
        EPS := TERM;
        IF(EPS<0) THEN
            EPS := -EPS;
        END IF;
        N := N+2;
        SF := -SF;
    END LOOP;
```

```
    RETURN CSIN;

END;

/
```

The cos function is:

```
--function_cos.sql: Write a function to calculate cos(x) using Taylor series
expansion.



CREATE OR REPLACE FUNCTION COSINE(

    X IN NUMBER

) RETURN NUMBER AS

    CCOS NUMBER;

    FACT NUMBER;

    N    NUMBER;

    TERM NUMBER;

    EPS  NUMBER;

    XRAD NUMBER;

    I    NUMBER;

    SF   NUMBER;

BEGIN

    XRAD := X*3.141592653589793/180;

    CCOS := 1;

    EPS := CCOS;

    IF(EPS < 0) THEN

        EPS := -EPS;

    END IF;
```

```
    N := 2;
    SF := -1;
    WHILE(EPS > 1e-12) LOOP
        FACT := 1;
        FOR I IN 1..N LOOP
            FACT := FACT*I;
        END LOOP;
        TERM := SF*XRAD**N/FACT;
        CCOS := CCOS + TERM;
        EPS := TERM;
        IF(EPS<0) THEN
            EPS := -EPS;
        END IF;
        N := N+2;
        SF := -SF;
    END LOOP;
    RETURN CCOS;
END;
/
```

The tan function is:

```
--function_tangent.sql: Write a function to calculate tan(x) sung sin(x)/cos(x).


CREATE OR REPLACE FUNCTION TANGENT(
    X IN NUMBER
) RETURN NUMBER AS
```

```
    Y NUMBER;
BEGIN
    Y := SINE(X)/COSINE(X);
    RETURN Y;
END;
/
```

The main function is:

```
--sin_cos_tan_main.sql: Write main program to call sin(x), cosine(x), tangent(x)
to calculate sin(x), cos(x), tan(x).


DECLARE
    X  NUMBER;
    Y1 NUMBER(15, 13);
    Y2 NUMBER(15, 13);
    Y3 NUMBER(18, 3);
BEGIN
    X := 0;
    WHILE(X <= 180) LOOP
        Y1 := SINE(X);
        Y2 := COSINE(X);
        Y3 := TANGENT(X);
        DBMS_OUTPUT.PUT_LINE('sin('
            ||X
            ||') = '
            ||Y1
```

```
            || '  cos('
            ||X
            ||') = '
            ||Y2
            || '  tan('
            ||X
            ||') = '
            ||Y3);
        X := X+5;
    END LOOP;
END;
/
```