Contents

Copyright

```
close all; format compact; clc;
fprintf("Engineer: Rodrigo Becerril Ferreyra\n");
fprintf("Company: California State University, Long Beach\n");
fprintf("Project Name: Task 3\n");
fprintf("Date: 18 September 2020\n");
```

```
Engineer: Rodrigo Becerril Ferreyra
Company: California State University, Long Beach
Project Name: Task 3
Date: 18 September 2020
```

Task 3.1

```
fprintf("\nTask 3.1\n");
clear variables;

% \sum_{i=1}^{100} \frac1{i^2}
i = 1:100;
f = 1./(i.^2);
result = sum(f);
fprintf("\\sum_{i=1}^{100} \\frac1{i^2} = %f\n", result);
```

```
Task 3.1
\sum_{i=1}^{100} \frac1{i^2} = 1.634984
```

Task 3.2

```
fprintf("\nTask 3.2\n");
clear variables;

i = 1 : 2 : 100;
f = 1./(i.^2);
result = sum(f);
fprintf("\\sum_{i=1}^{100} \\frac1{i^2}, i mod 2 == 1 is %f\n", result);
```

```
Task 3.2
\sum_{i=1}^{100} \frac1{i^2}, i mod 2 == 1 is 1.228701
```

Task 3.3

```
fprintf("\nTask 3.3\n");
clear variables;

% I_N = \sum_{i=1}^N \frac{\sin\left( i\pi/2 \right)}{i^2 + 1}
I = zeros(1, 20);
for N = 1:20

    total = 0;
    for i = 1:N
        top = sin(i * pi * 0.5);
        bot = i^2 + 1;
        total = total + top/bot;
    end
    I(N) = total;

end
```

```
Task 3.3
```

Task 3.4

```
fprintf("\nTask 3.4\n");
clear variables;

x = 0 : pi/4 : pi;
f = x.^2 + 1;
disp([x ; f]);
```

```
Task 3.4
         0    0.7854    1.5708    2.3562    3.1416
```

```
    1.0000    1.6169    3.4674    6.5517   10.8696
```

Task 3.5

```
fprintf("\nTask 3.5\n");
clear variables;

N = 10;
x = [0, 1/4, 1/2, 3/4];
approxCosX = zeros(1, 4);

for index = 1:4

    total = 0;
    for n = 0:N
        top = x(index)^(2 * n);
        bot = factorial(2 * n);
        multiplier = (-1)^(n);
        total = total + (multiplier * top / bot);
    end
    approxCosX(index) = total;

end

fprintf("1st row: x vals. 2nd row: cos(x). 3rd row: Taylor series to 10 terms.\n")
format long;
disp([x;cos(x);approxCosX]);
format; format compact;
```

```
Task 3.5
1st row: x vals. 2nd row: cos(x). 3rd row: Taylor series to 10 terms.
  Columns 1 through 3
                   0   0.250000000000000   0.500000000000000
   1.000000000000000   0.968912421710645   0.877582561890373
   1.000000000000000   0.968912421710645   0.877582561890373
  Column 4
   0.750000000000000
   0.731688868873821
   0.731688868873821
```

Task 3.6

```
fprintf("\nTask 3.6\n");
clear variables;

S = zeros(1, 1000);
len = length(S);
for N = 1:len

    n = 1:N;
    f = 1./(n.^2);
    S(N) = sum(f);
```

```
end

c = pi^2/S(end);
fprintf("Last value of S: S(%d) = %f\nc = %f\n", len, S(end), c);
```

```
Task 3.6
Last value of S: S(1000) = 1.643935
c = 6.003648
```

Task 3.7

```
fprintf("\nTask 3.7\n");
clear variables;

vals = [1, 2, 3, 4];
answers = zeros(1, 4);
for p = vals

    total = 0;
    for j = 1:(p + 1)
        total = total + j^p;
    end
    answers(p) = total;

end

answers
```

```
Task 3.7
answers =
     3    14   100   979
```

Task 3.8

```
fprintf("\nTask 3.8\n");
clear variables;

N = 1000;
total = 0;
for n = 1:N
    multiplier = (-1)^n;
    total = total + (multiplier/n);
end

fprintf("Relative error of approximating -ln(2) (N = %d): %f\n", N, abs(log(0.5) - total) / log(2));

N = 1000;
total = 0;
for n = 1:N
    bot = n * (n + 1);
    total = total + 1/bot;
end

fprintf("Relative error of approximating 2 (N = %d): %f\n", N, abs(2 - total) / 2);
```

```
Task 3.8
Relative error of approximating -ln(2) (N = 1000): 0.000721
Relative error of approximating 2 (N = 1000): 0.500500
```

Task 3.9

```
fprintf("\nTask 3.9\n");
clear variables;

x = -10:10;
disp([x;x > 2 & x < 4]);
disp([x;x > 3 | x < -1]);
```

```
Task 3.9
  Columns 1 through 13
   -10    -9    -8    -7    -6    -5    -4    -3    -2    -1     0     1     2
     0     0     0     0     0     0     0     0     0     0     0     0     0
  Columns 14 through 21
     3     4     5     6     7     8     9    10
     1     0     0     0     0     0     0     0
  Columns 1 through 13
   -10    -9    -8    -7    -6    -5    -4    -3    -2    -1     0     1     2
     1     1     1     1     1     1     1     1     1     0     0     0     0
  Columns 14 through 21
     3     4     5     6     7     8     9    10
     0     1     1     1     1     1     1     1
```

Task 3.10

```
fprintf("\nTask 3.10\n");
clear variables;

x = 0:100;
disp([x;x>20 & mod(x, 2) == 0]);
```

```
Task 3.10
  Columns 1 through 13
     0     1     2     3     4     5     6     7     8     9    10    11    12
     0     0     0     0     0     0     0     0     0     0     0     0     0
  Columns 14 through 26
    13    14    15    16    17    18    19    20    21    22    23    24    25
     0     0     0     0     0     0     0     0     0     1     0     1     0
  Columns 27 through 39
    26    27    28    29    30    31    32    33    34    35    36    37    38
     1     0     1     0     1     0     1     0     1     0     1     0     1
  Columns 40 through 52
    39    40    41    42    43    44    45    46    47    48    49    50    51
     0     1     0     1     0     1     0     1     0     1     0     1     0
  Columns 53 through 65
    52    53    54    55    56    57    58    59    60    61    62    63    64
     1     0     1     0     1     0     1     0     1     0     1     0     1
  Columns 66 through 78
    65    66    67    68    69    70    71    72    73    74    75    76    77
     0     1     0     1     0     1     0     1     0     1     0     1     0
  Columns 79 through 91
    78    79    80    81    82    83    84    85    86    87    88    89    90
     1     0     1     0     1     0     1     0     1     0     1     0     1
  Columns 92 through 101
    91    92    93    94    95    96    97    98    99   100
     0     1     0     1     0     1     0     1     0     1
```

Task 3.11

```
fprintf("\nTask 3.11\n");
clear variables;

x = 1;
if(tan(73*pi*x/4) >= 0)
    x = 2;
else
    x = pi;
end
if(floor(x) == x)
    x = 10;
else
    x = 7;
end
if(isprime(x))
    x = "True";
else
    x = "False";
end
fprintf("%s\n", x);
```

```
Task 3.11
False
```

Task 3.12

```
fprintf("\nTask 3.12\n");
clear variables;

% This loops for a long time.
% x = [1/7, 0];
% iterations = 0;
% while(x(2) ~= x(1))
    % x(2) = mod((5 * x(1)), 1);
    % x(1) = x(1) + x(2);
    % x(2) = x(1) - x(2);
    % x(1) = x(1) - x(2);
    % iterations = iterations + 1;
% end
% fprintf("Iterations: %d", iterations);
```

```
Task 3.12
```

Task 3.13

```
fprintf("\nTask 3.13\n");
clear variables;

integers = 1:50;

f = @(n) n.^3 - n.^2 + 40;
for n = integers
    if (mod(n, 3) ~= 0) && (f(n) > 1000)
        fprintf("%d ", n);
    end
end
fprintf("\n");

for n = integers
    if (sum(divisors(n)) - n) == n
        fprintf("%d ", n);
    end
end
fprintf("\n");
```

```
Task 3.13
11 13 14 16 17 19 20 22 23 25 26 28 29 31 32 34 35 37 38 40 41 43 44 46 47 49 50
6 28
```

Task 3.14

```
fprintf("\nTask 3.14\n");
clear variables;

alphabet = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j'];
while(1)
    %user_input = input("Enter an integer from 1 to 10: ");
    user_input = 10;
    if user_input <= 10 && user_input >= 1 && floor(user_input) == user_input
        break;
    end
    fprintf("That is not a valid integer. Please try again.\n")
end

disp(alphabet(1:user_input));
```

```
Task 3.14
abcdefghij
```

Task 3.15

```
fprintf("\nTask 3.15\n");
clear variables;

%ui1 = input("Enter a letter: ");
%ui2 = input("Enter a number: ");
```

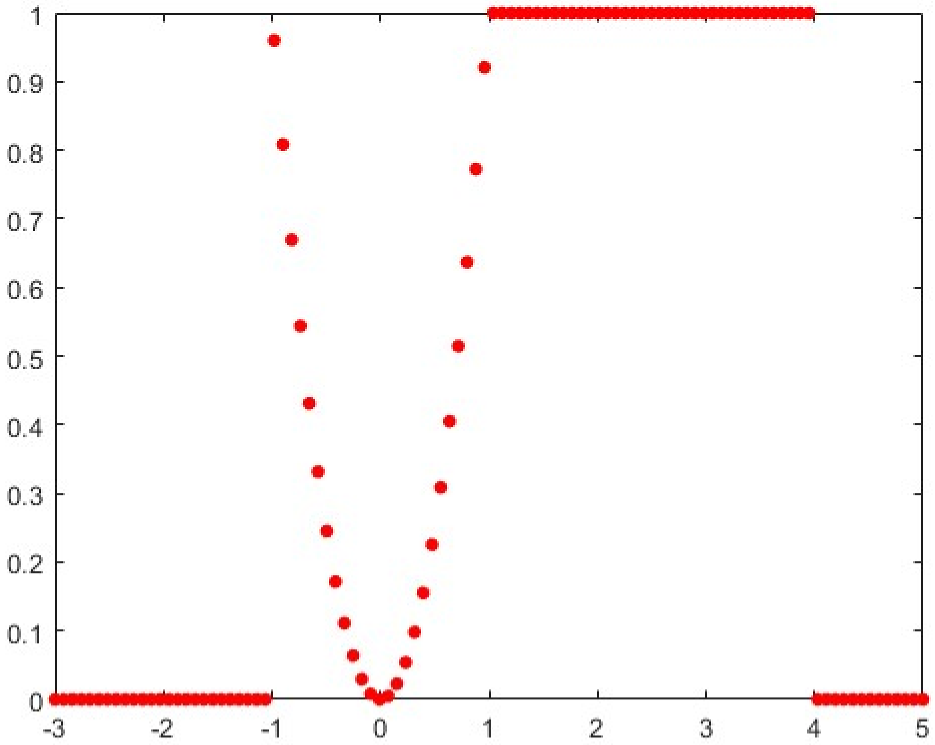
```
Task 3.15
```

Task 3.16

```
fprintf("\nTask 3.16\n");
clear variables;

x = linspace(-3, 5, 100);
f = zeros(1, 100);
for i = 1:100
    if     x(i) < -1
        f(i) = 0;
    elseif x(i) <= 1
        f(i) = x(i)^2;
    elseif x(i) < 4
        f(i) = 1;
    else
        f(i) = 0;
    end
end
figure(); plot(x, f, 'r.', 'MarkerSize',15);
```

```
Task 3.16
```

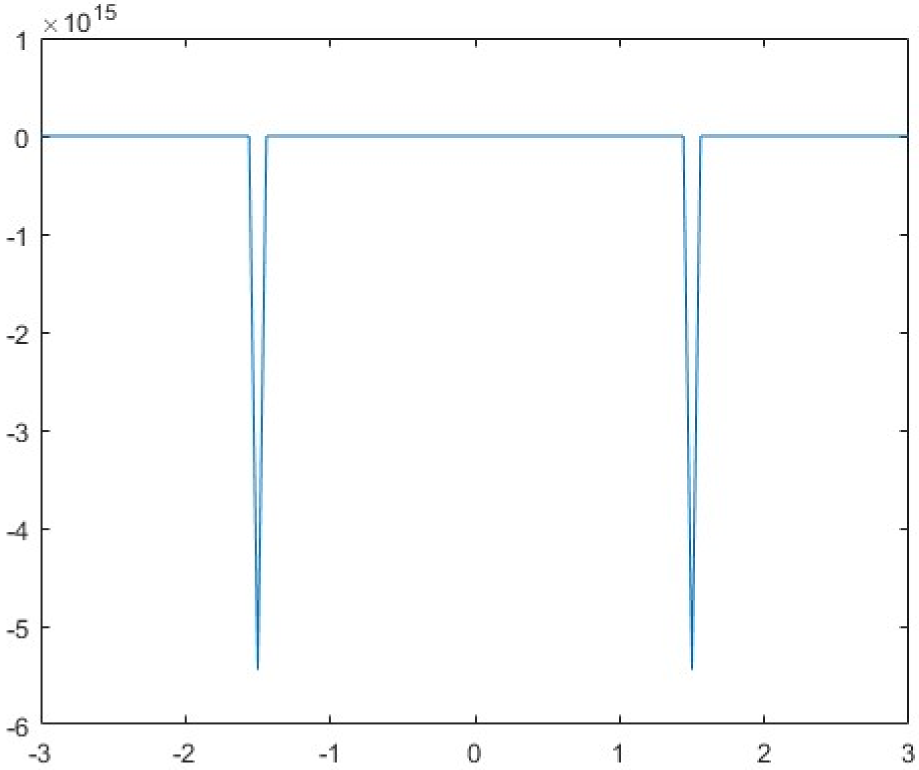


Task 3.17

```
fprintf("\nTask 3.17\n");
clear variables;

x = linspace(-3, 3, 101);
g = cos(pi.*x);
f(g==0) = NaN;
f(g~=0) = 1./g(g~=0);
figure(); plot(x, f);
```

```
Task 3.17
```



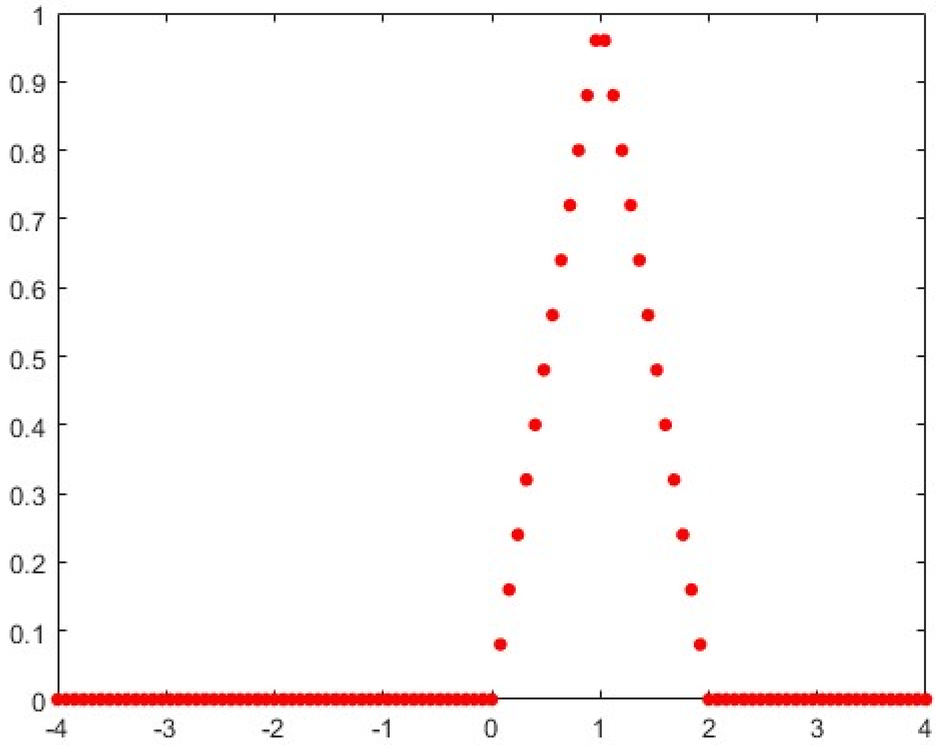
Task 3.18

```
fprintf("\nTask 3.18\n");
clear variables;

x = linspace(-4, 4, 101);
for i = 1:101
    if     x(i) < 0
        f(i) = 0;
    elseif x(i) <= 1
        f(i) = x(i);
    elseif x(i) <= 2
        f(i) = 2 - x(i);
    else
        f(i) = 0;
    end
end

figure(); plot(x, f, 'r.', 'MarkerSize',15);
```

```
Task 3.18
```



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