

PRACTICAL NO.1

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MAT/19/80

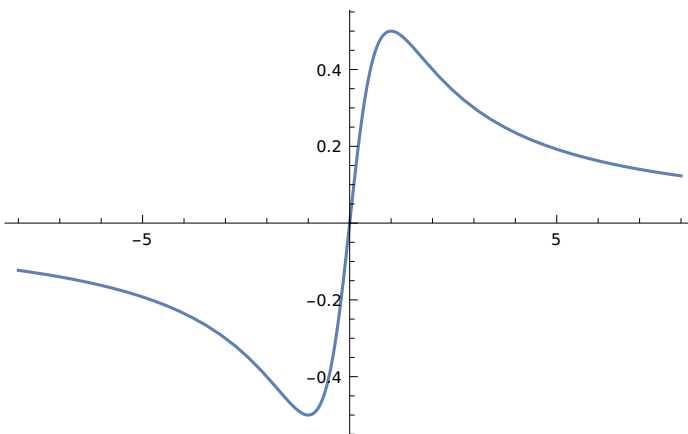
Que1. Graph each of the functions. Experiment with different domains or view points to display the best images.

a) $f(x) = x/(1+x^2)$

```
In[9]:= f[x_] := x / (1 + x ^ 2)
```

```
In[10]:= Plot[f[x], {x, -8, 8}]
```

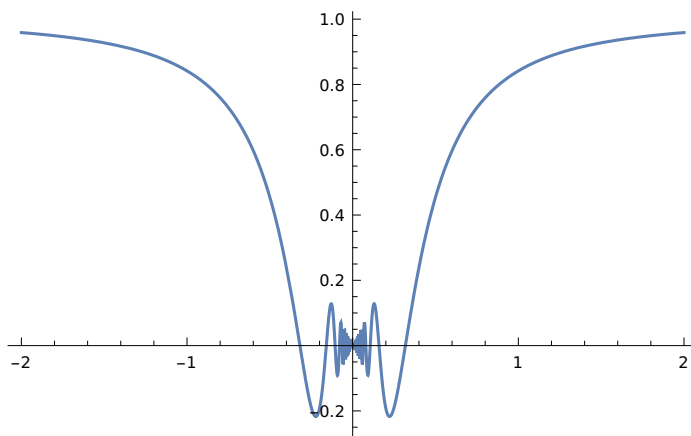
Out[10]=



b) $y = x \sin(1/x)$

```
In[11]:= Plot[x * Sin[1 / x], {x, -2, 2}]
```

```
Out[11]=
```

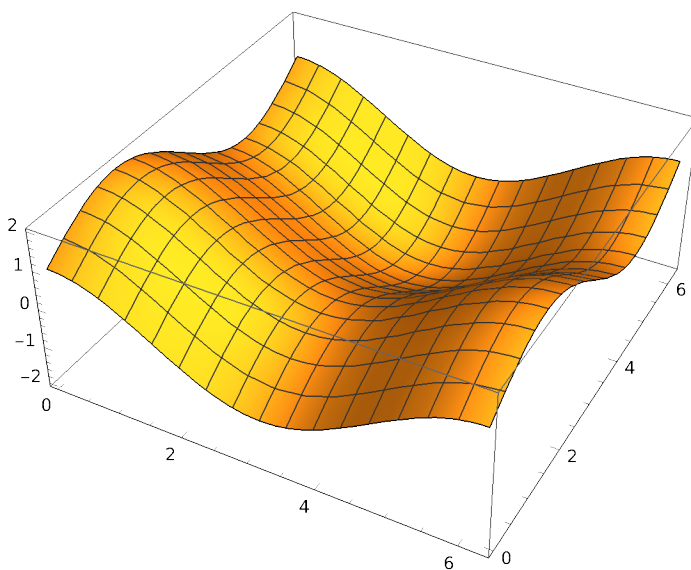


c) $g(x,y) = \cos(x) + \sin(y)$

```
In[13]:= g[x_, y_] := Cos[x] + Sin[y]
```

```
In[15]:= Plot3D[g[x, y], {x, 0, 2 Pi}, {y, 0, 2 Pi}]
```

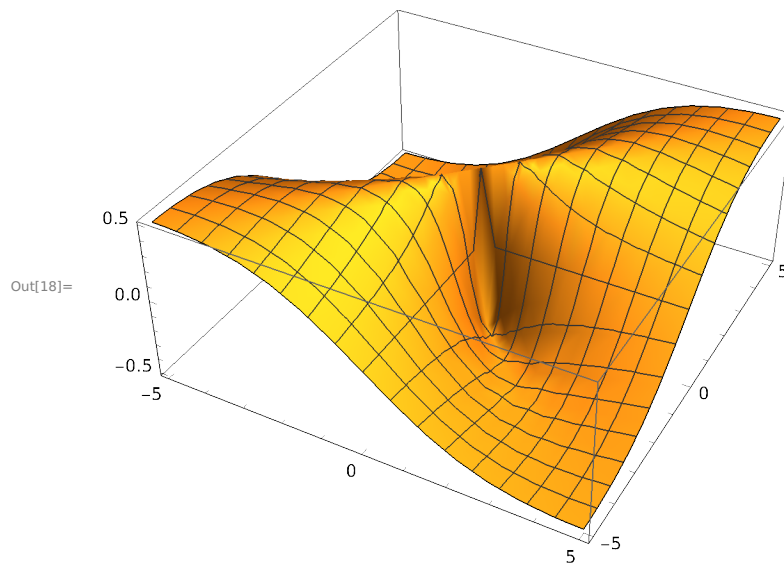
```
Out[15]=
```



d) $z = xy/(x^2 + y^2)$

```
In[16]:= z[x_, y_] := x * y / (x ^ 2 + y ^ 2)
```

In[18]:= **Plot3D**[z[x, y], {x, -5, 5}, {y, -5, 5}]



Que2. $f(x) = x/(1+x^2)$

In[32]:= **f[x_] := x / (1 + x ^ 2)**

In[33]:= **A = D[f[x], x]**

Out[33]=
$$-\frac{2x^2}{(1+x^2)^2} + \frac{1}{1+x^2}$$

In[34]:= **B = D[f'[x], x]**

Out[34]=
$$\frac{8x^3}{(1+x^2)^3} - \frac{6x}{(1+x^2)^2}$$

In[36]:= **A /. {x → -1}**

Out[36]= 0

In[38]:= **A /. {x → 0}**

Out[38]= 1

In[39]:= **B /. {x → 0}**

Out[39]= 0

In[40]:= **B /. {x → 1}**

Out[40]=
$$-\frac{1}{2}$$

Que3.

a) 3,527,218,133,309,949,276,293

```
In[41]:= FactorInteger [3 527 218 133 309 949 276 293 ]
```

```
Out[41]= {{15 013 , 2}, {25 013 , 3}}
```

b) 471,945,325,930,166,269

```
In[42]:= FactorInteger [471 945 325 930 166 269 ]
```

```
Out[42]= {{4211 , 1}, {34 589 , 1}, {46 747 , 1}, {69 313 , 1}}
```

c) 471,945,325,930,166,281

```
In[43]:= FactorInteger [471 945 325 930 166 281 ]
```

```
Out[43]= {{471 945 325 930 166 281 , 1}}
```

Que4.

a) $3^6 \bmod 7$

```
In[44]:= Mod[3 ^ 6, 7]
```

```
Out[44]= 1
```

b) $6^{10} \bmod 11$

```
In[45]:= Mod[6 ^ 10, 11]
```

```
Out[45]= 1
```

c) $7^{20} \bmod 21$

```
In[46]:= Mod[7 ^ 20, 21]
```

```
Out[46]= 7
```

d) $7^{22} \bmod 23$

```
In[47]:= Mod[7 ^ 22, 23]
Out[47]= 1
```

Que8.

a)

```
In[48]:= M = {{1, 1}, {1, 0}}
Out[48]= {{1, 1}, {1, 0}}

In[53]:= f[n_] := f[n] = M ^ n;
In[56]:= Table[f[n], {n, 2, 10}]
Out[56]= {{{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}},
          {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}},
          {{1, 1}, {1, 0}}, {{1, 1}, {1, 0}}}
```

b)

```
In[78]:= ClearAll[f]
In[79]:= f[0] = 1;
In[80]:= f[1] = 1;
In[81]:= f[n_] := f[n] = f[n - 2] + f[n - 1];
In[82]:= f[n] /. {n -> 100}
Out[82]= 573 147 844 013 817 084 101
```

Que9.

a)

```
In[90]:= Solve[x ^ 2 + x == 1, x]
Out[90]= {{x ->  $\frac{1}{2}(-1 - \sqrt{5})$ }, {x ->  $\frac{1}{2}(-1 + \sqrt{5})$ }}
```

b)

```
In[91]:= Solve[x^2 + x == -1, x]
Out[91]= {{x -> -(-1)^(1/3)}, {x -> (-1)^(2/3)}}
```

c)

```
In[92]:= Solve[{4 x - 3 y == 5, 6 x + 2 y == 14}, {x, y}]
Out[92]= {{x -> 2, y -> 1}}
```

d)

```
In[93]:= Solve[{-2 x - 2 y + 3 z + t == 8, -3 x + 0 y - 6 z + t == -19,
               6 x - 8 y + 6 z + 5 t == 47, x + 3 y - 3 z - t == -9}, {x, y, z, t}]
Out[93]= {{x -> 2, y -> 1, z -> 3, t -> 5}}
```

Que10.

```
In[1]:= FindRoot[
          250 * Exp[1.0 * r] + 300 * Exp[0.75 * r] + 350 * Exp[0.5 * r] + 400 * Exp[0.25 * r] == 1365, {r, 0}]
Out[1]= {r -> 0.084104}
```

Que11.

```
In[2]:= mysqrt[n_] := Module[{i = 1, g = 1}, While[i ≤ 20, g = (g + n/g)/2; i = i + 1]; g]
In[3]:= N[mysqrt[2], 6]
Out[3]= 1.41421

In[4]:= N[mysqrt[3]]
Out[4]= 1.73205
```

Que12.

```
In[7]:= Clear[collatz];
In[8]:= collatz[n_] := Which[n == 1, collatz[n] = 0, EvenQ[n],
                             collatz[n] = 1 + collatz[n/2], OddQ[n], collatz[n] = 1 + collatz[3 * n + 1]]
```

```
In[9]:= collatz[27]
```

```
Out[9]= 111
```