PRACTICAL 1

Solution of first order differential equation.

- **Ordinary DifferentialEquations (ODEs), in which there is a single independent variable and more dependent variable**

1.Solve the Differential equation dy/dx=6(x ^2)+2*x+3.

In[1]:=
```
sol1 = DSolve [{y '[x] == 6 * (x ^ 2) + 2 * x + 3}, y[x], x]
```

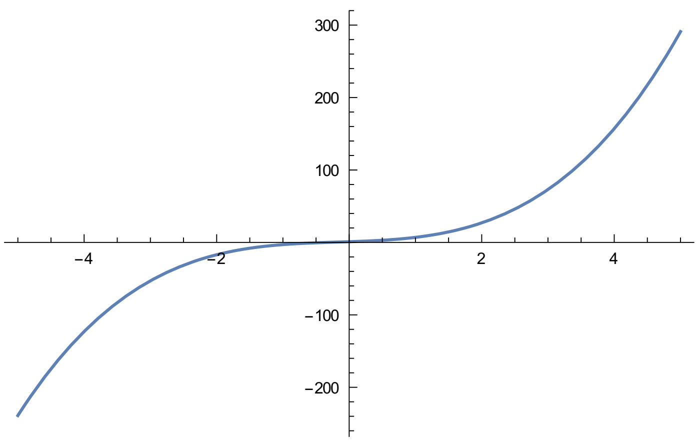
Out[1]= $\{\{y[x] \to 3x + x^2 + 2x^3 + c_1\}\}$

In[2]:=
```
A = y[x] /. sol1 /. {C[1] → 1}
```

Out[2]= $\{1 + 3x + x^2 + 2x^3\}$

In[7]:=
```
Plot [A, {x, -5, 5}]
```

Out[7]=



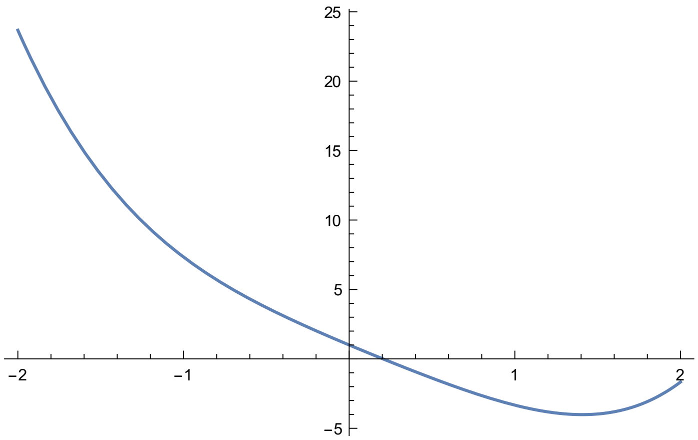
2.dy/dx=2(x^3)-x^2+x-5,y(0)=1

In[3]:=
```
sol2 = DSolve [{y '[x] == 2 * (x ^ 3) - x ^ 2 + x - 5, y[0] == 1}, y[x], x]
```

Out[3]= $\left\{\left\{y[x] \to \frac{1}{6}\left(6 - 30x + 3x^2 - 2x^3 + 3x^4\right)\right\}\right\}$

In[4]:=
```
Plot[y[x] /. sol2 , {x, -2, 2}]
```

Out[4]=



3.dy/dx+(x+2)y^2=0

In[6]:=
```
sol3 = DSolve[{y'[x] + (x + 2) * y[x]^2 == 0}, y[x], x]
```

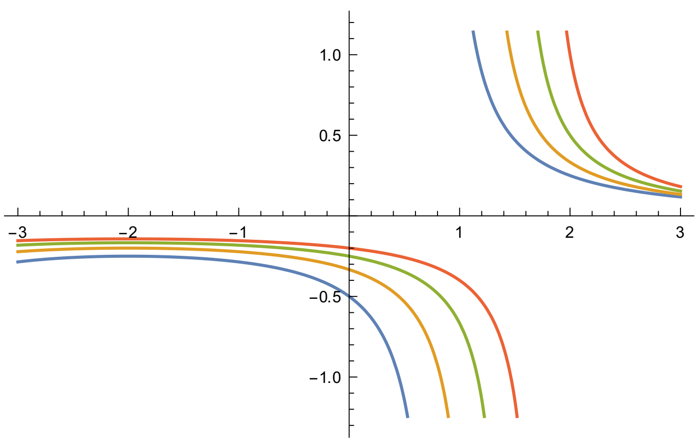
Out[6]= $\left\{\left\{y[x] \to \frac{2}{4\,x + x^2 - 2\,c_1}\right\}\right\}$

In[7]:=
```
A = Table[y[x] /. sol3 /. {C[1] → k}, {k, 2, 5}]
```

Out[7]= $\left\{\left\{\frac{2}{-4 + 4\,x + x^2}\right\}, \left\{\frac{2}{-6 + 4\,x + x^2}\right\}, \left\{\frac{2}{-8 + 4\,x + x^2}\right\}, \left\{\frac{2}{-10 + 4\,x + x^2}\right\}\right\}$

In[9]:=
```
Plot[A, {x, -3, 3}]
```

Out[9]=



4.dy/dx=1+y^2

In[33]:=
```
sol4 = DSolve[y'[x] == 1 + y[x]^2, y[x], x]
```

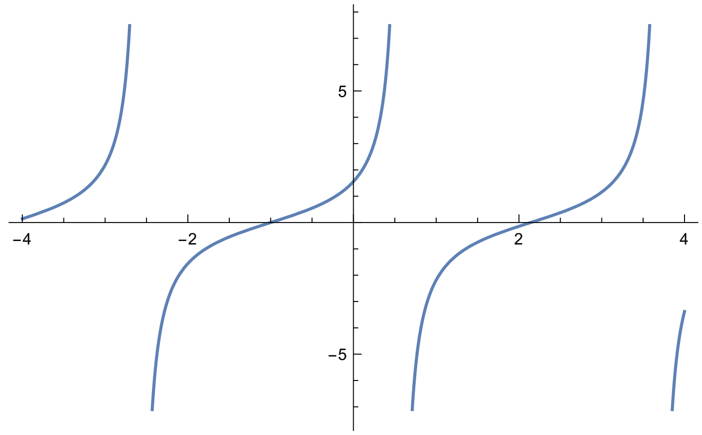
Out[33]= $\{\{y[x] \to \mathrm{Tan}[x + c_1]\}\}$

In[11]:=
```
A = y[x] /. sol4 /. {C[1] → 1}
```

Out[11]= {Tan[1 + x]}

In[13]:= `Plot[A, {x, -4, 4}]`

Out[13]=



5.dy/dx=4*x+y+1

In[14]:= `sol5 = DSolve[y'[x] == (4 * x) + y[x] + 1, y[x], x]`

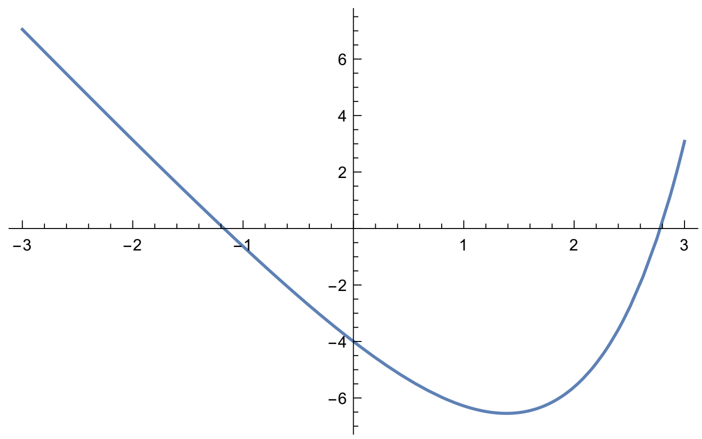
Out[14]= $\{\{y[x] \to -5 - 4\,x + e^{x}\,c_1\}\}$

In[15]:= `B = y[x] /. sol5 /. {C[1] → 1}`

Out[15]= $\{-5 + e^{x} - 4\,x\}$

In[17]:= `Plot[B, {x, -3, 3}]`

Out[17]=



6.2*x*y*dy/dx=x^2+y^2

In[20]:= `sol6 = DSolve[2 * x * y[x] * y'[x] == (x ^ 2) + y[x] ^ 2, y[x], x]`

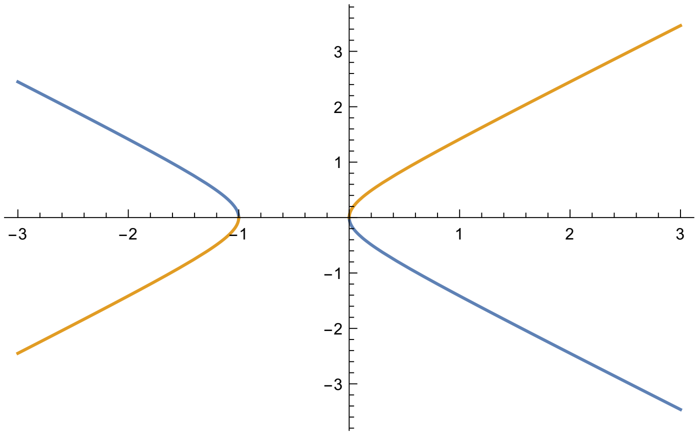
Out[20]= $\left\{\left\{y[x] \to -\sqrt{x}\,\sqrt{x + c_1}\right\}, \left\{y[x] \to \sqrt{x}\,\sqrt{x + c_1}\right\}\right\}$

In[21]:= `B = y[x] /. sol6 /. {C[1] → 1}`

Out[21]= $\left\{-\sqrt{x}\,\sqrt{1 + x}, \sqrt{x}\,\sqrt{1 + x}\right\}$

In[23]:=
```
Plot[B, {x, -3, 3}]
```

Out[23]=



7.dy/dx=(y^2-x^2)/2*x*y

In[24]:=
```
sol7 = DSolve[y'[x] == (y[x]^2 - x^2)/(2*x*y[x]), y[x], x]
```

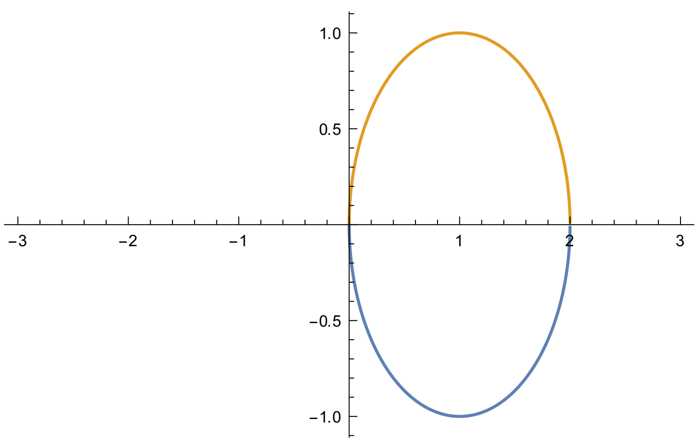
Out[24]= $\left\{\left\{y[x] \to -\sqrt{-x^2 + x\,c_1}\right\}, \left\{y[x] \to \sqrt{-x^2 + x\,c_1}\right\}\right\}$

In[31]:=
```
B = y[x] /. sol7 /. {C[1] → 2}
```

Out[31]= $\left\{-\sqrt{2x - x^2}, \sqrt{2x - x^2}\right\}$

In[32]:=
```
Plot[B, {x, -3, 3}]
```

Out[32]=



8.Check whether the following differential equation are exact or not.

a)(x+2y)dx+(2x-y)dy=0

In[7]:=
```
P[x_, y_] := (x + 2*y)
```

In[2]:=
```
Q[x_, y_] := (2*x - y)
```

In[8]:=
```
Simplify[D[P[x, y], y] - D[Q[x, y], x]]
```

Out[8]= 0

In[12]:=
```
eqn = (y '[x] == -P[x, y[x]] / Q[x, y[x]])
```

Out[12]=
$$y'[x] == \frac{-x - 2\ y[x]}{2\ x - y[x]}$$

In[10]:=
```
Expand [eqn]
```

Out[10]=
$$y'[x] == -\frac{x}{2\ x - y[x]} - \frac{2\ y[x]}{2\ x - y[x]}$$

In[11]:=
$$\text{FullSimplify}\left[y'[x] == -\frac{x}{2\ x - y[x]} - \frac{2\ y[x]}{2\ x - y[x]}\right]$$

Out[11]=
$$y'[x] == 2 + \frac{5\ x}{-2\ x + y[x]}$$

b)(x^2+2*y^2)dx+(4*x*y-y^2)dy=0

In[13]:=
```
P[x_, y_] := (x ^ 2 + 2 * y ^ 2)
```

In[14]:=
```
Q[x_, y_] := (4 * x * y - y ^ 2)
```

In[15]:=
```
Simplify [D[P[x, y], y] - D[Q[x, y], x]]
```

Out[15]= 0

In[16]:=
```
eqn = (y '[x] == -P[x, y[x]] / Q[x, y[x]])
```

Out[16]=
$$y'[x] == \frac{-x^2 - 2\ y[x]^2}{4\ x\ y[x] - y[x]^2}$$

In[17]:=
```
Expand [eqn]
```

Out[17]=
$$y'[x] == -\frac{x^2}{4\ x\ y[x] - y[x]^2} - \frac{2\ y[x]^2}{4\ x\ y[x] - y[x]^2}$$

c)(2*x^2+2*x*y+y^2)dx+(x^2+2*x*y)dy=0

In[18]:=
```
P[x_, y_] := (2 * x ^ 2 + 2 * x * y + y ^ 2)
```

In[19]:=
```
Q[x_, y_] := (x ^ 2 + 2 * x * y)
```

In[20]:=
```
Simplify [D[P[x, y], y] - D[Q[x, y], x]]
```

Out[20]= 0

In[21]:=
```
eqn = (y '[x] == -P[x, y[x]] / Q[x, y[x]])
```

Out[21]=
$$y'[x] == \frac{-2\ x^2 - 2\ x\ y[x] - y[x]^2}{x^2 + 2\ x\ y[x]}$$

In[22]:=
```
Expand [eqn]
```

Out[22]=
$$y'[x] == -\frac{2\ x^2}{x^2 + 2\ x\ y[x]} - \frac{2\ x\ y[x]}{x^2 + 2\ x\ y[x]} - \frac{y[x]^2}{x^2 + 2\ x\ y[x]}$$