PRACTICAL - 1

SOLUTION OF FIRST ORDER DIFFERENTIAL EQUATION

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

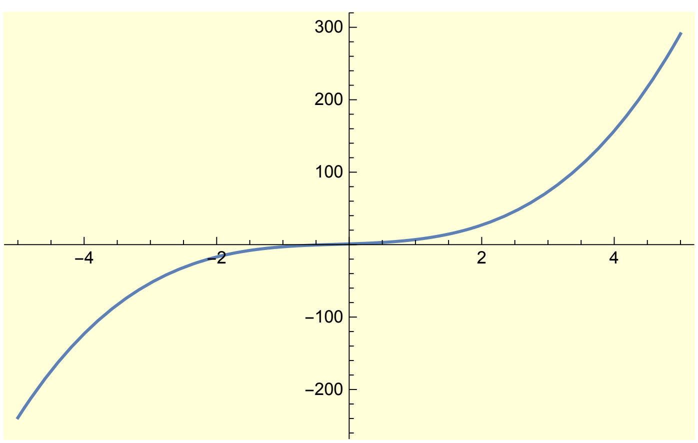
Out[ ]= $\{\{y[x] \to 3x + x^2 + 2x^3 + C[1]\}\}$

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

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

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

Out[ ]=

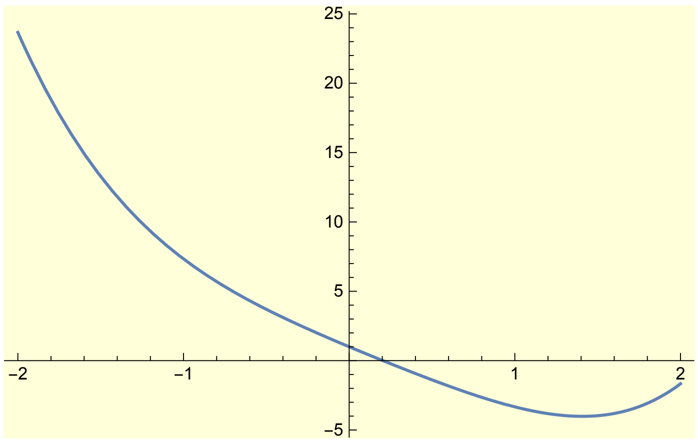


2.dy/dx=2(x^3)-x^2+x-5,y(0)=1

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

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

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

Out[ ]=


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

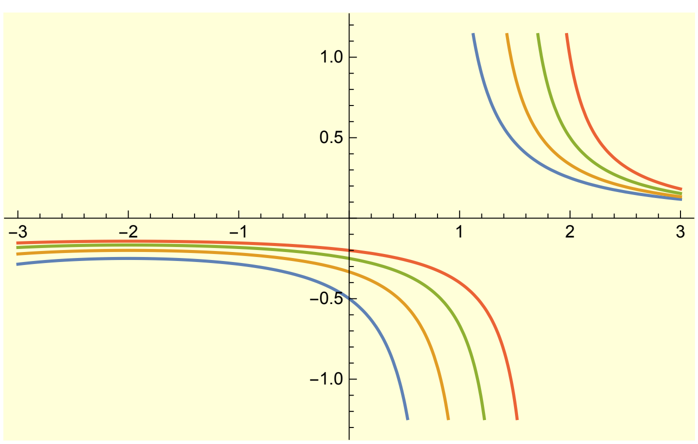
In[ ]:= `sol3 = DSolve[{y'[x] + (x + 2) * y[x] ^2 == 0}, y[x], x]`

Out[ ]= $\left\{\left\{y[x] \to \frac{2}{4x + x^2 - 2\,C[1]}\right\}\right\}$

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

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

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

Out[ ]=


4.dy/dx=1+y^2

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

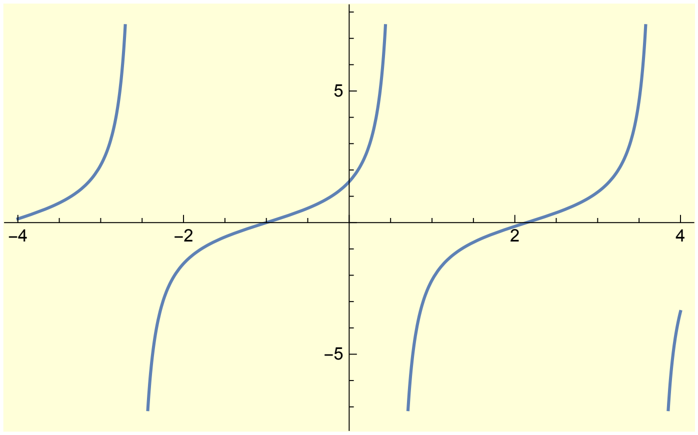
Out[ ]= `{{y[x] → Tan[x + C[1]]}}`

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

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

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

Out[ ]=

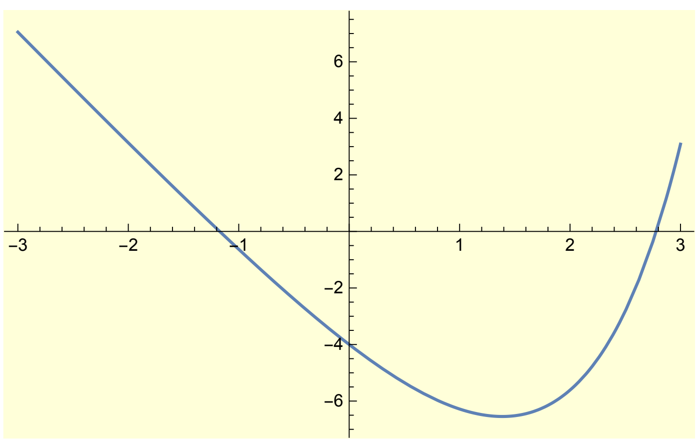


5.dy/dx=4*x+y+1

In[ ]:=
```
sol5 = DSolve[y'[x] == (4 * x) + y[x] + 1, y[x], x]
```
Out[ ]= $\{\{y[x] \to -5 - 4x + e^{x} C[1]\}\}$

In[ ]:=
```
B = y[x] /. sol5 /. {C[1] → 1}
```
Out[ ]= $\{-5 + e^{x} - 4x\}$

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

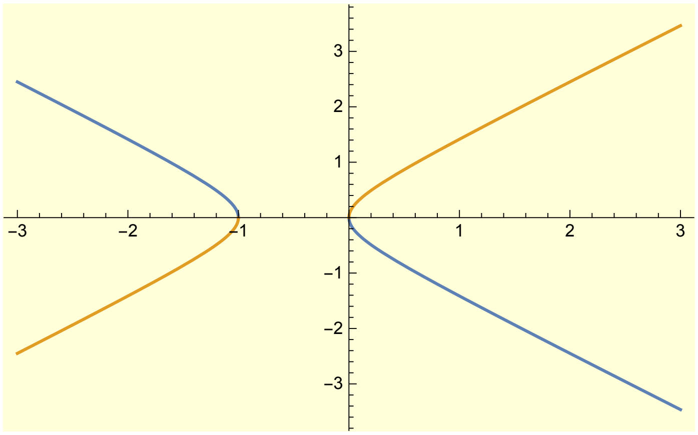


*6. 2*x*y*dy/dx=x^2+y^2*

In[ ]:=
```
sol6 = DSolve[2 * x * y[x] * y'[x] == (x^2) + y[x]^2, y[x], x]
```
Out[ ]= $\{\{y[x] \to -\sqrt{x}\sqrt{x + C[1]}\}, \{y[x] \to \sqrt{x}\sqrt{x + C[1]}\}\}$

In[ ]:=
```
B = y[x] /. sol6 /. {C[1] → 1}
```
Out[ ]= $\{-\sqrt{x}\sqrt{1 + x}, \sqrt{x}\sqrt{1 + x}\}$

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

Out[ ]=


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

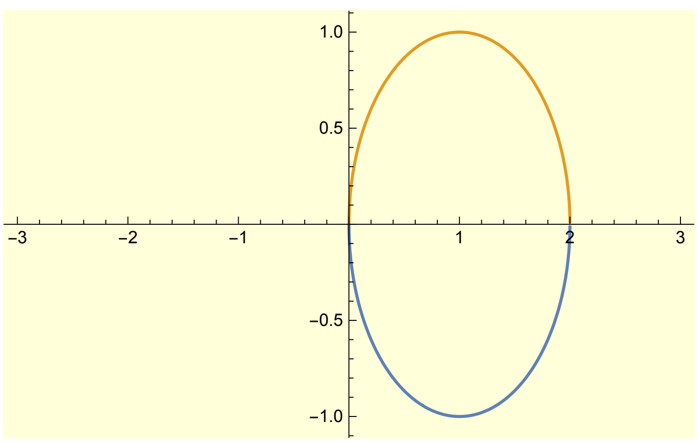
In[ ]:=
```
sol7 = DSolve[y'[x] == (y[x]^2 - x^2) / (2 * x * y[x]), y[x], x]
```

Out[ ]= $\left\{\left\{y[x] \to -\sqrt{-x^2 + x\,C[1]}\right\}, \left\{y[x] \to \sqrt{-x^2 + x\,C[1]}\right\}\right\}$

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

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

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

Out[ ]=


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

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

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

Out[ ]= 0

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

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

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

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

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

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

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

In[ ]:=
```
P[x_, y_] := (x^2 + 2 * y^2)
Q[x_, y_] := (4 * x * y - y^2)
Simplify[D[P[x, y], y] - D[Q[x, y], x]]
```

Out[ ]= 0

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

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

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

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

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

In[ ]:=
```
P[x_, y_] := (2 * x^2 + 2 * x * y + y^2)
Q[x_, y_] := (x^2 + 2 * x * y)
Simplify[D[P[x, y], y] - D[Q[x, y], x]]
```

Out[ ]= 0

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

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

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

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