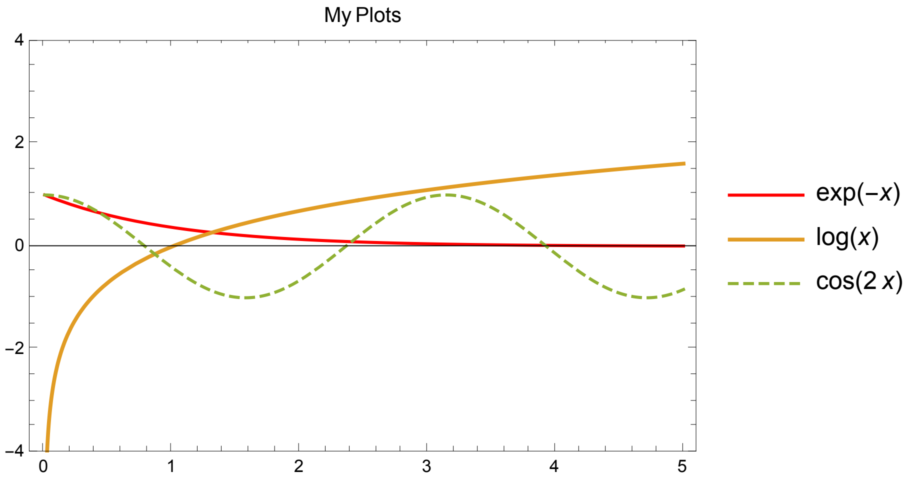
Ques. 1

```
N[Pi]
3.14159

N[Pi, 10]
3.141592654

N[E, 10]
2.718281828

N[Pi, 100]
3.14159265358979323846264338327950288419716939937510582097494459230781640628622
 0899862803482534211706 8

N[{2^(1/2), 2^(1/6)}, 16]
{1.414213562373095, 1.122462048309373}
```

Ques. 2

```
Plot[{Exp[-x], Log[x], Cos[2 x]}, {x, 0, 5}, PlotRange → {-4, 4},
 PlotLabel → My Plots, PlotLegends → "Expressions",
 PlotStyle → {Red, Thick, Dashed}, Frame → True, PlotStyle → {Red, Green, Blue}]
```



Ques. 3 (Self Doable)

Ques. 4

$$2\,a\,x_{min} + b = 0 \quad \Rightarrow \quad x_{min} = \frac{-b}{2\,a}$$

$$y_{min} = \left(a\,x^2 + b\,x + c\right)_{x=x_{min}} \quad \Rightarrow \quad y_{min} = -\frac{b^2}{4\,a} + c$$

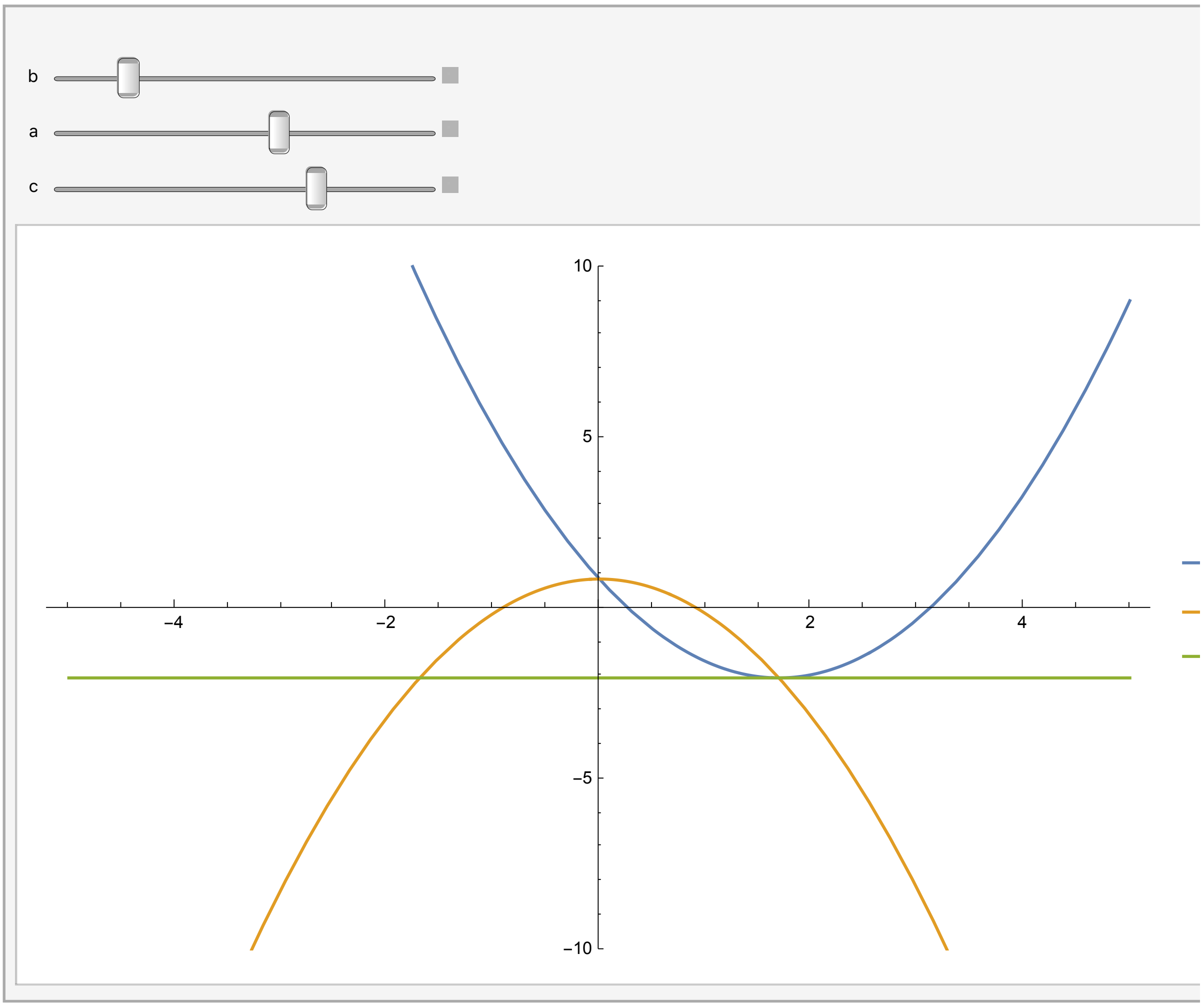
Eliminate b, to get an equation of y_{min} as a function of x_{min}, to get:

$$y_{min} = -a\,x_{min}^2 + c$$

This is the parabola on which the minima lies upon. Plot this parabola, alongside $y = a\,x^2 + b\,x + c$, as shown below. We have adjusted Manipulate command to also vary a and c. Varying b, you can see that the minima of the parabola lies on the parabola $c - a\,x^2$.

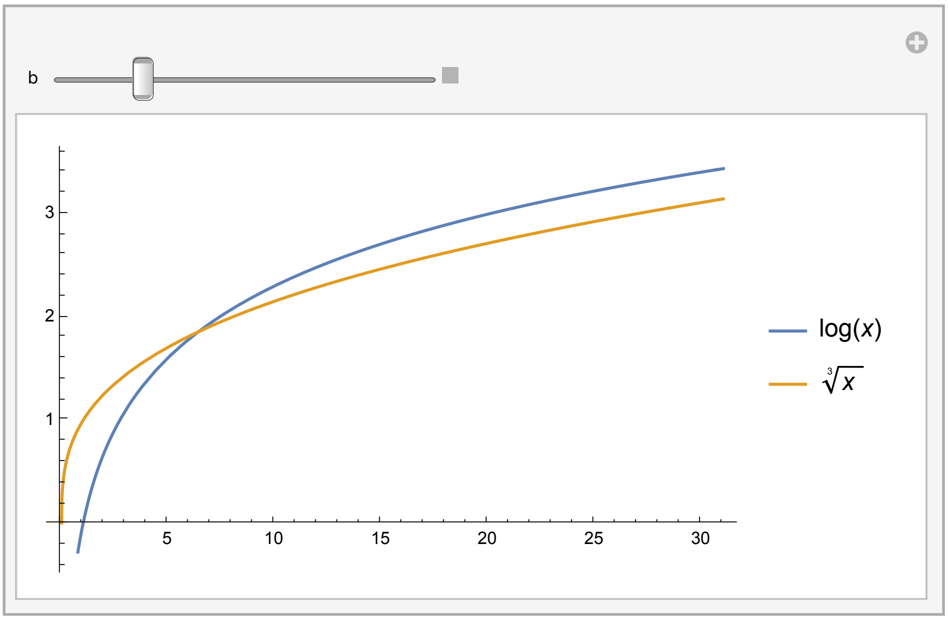
In[400]:=
```
Manipulate[Plot[{a x^2 + b x + c, c - a x^2, (-b^2 + 4 a c)/(4 a)} // Evaluate,
  {x, -5, 5}, ImageSize → Large, PlotRange → {-10, 10},
  PlotLegends → "Expressions"], {b, -5, 5}, {a, -5, 5}, {c, -2, 2}]
```

Out[400]=



Ques. 5

```
Manipulate[
 Plot[{Log[x], x^(1/3)}, {x, 0, b}, PlotLegends -> "Expressions"], {b, 1, 150, 0.1}]
```




```
NSolve[Log[x] - x^(1/3) == 0, x]
```

NSolve: Inverse functions are being used by NSolve, so some solutions may not be found; use Reduce for complete solution information.

{{x → 6.40567}, {x → 93.3545}}

```
Reduce[Log[x] - x^(1/3) == 0, x] // N
```

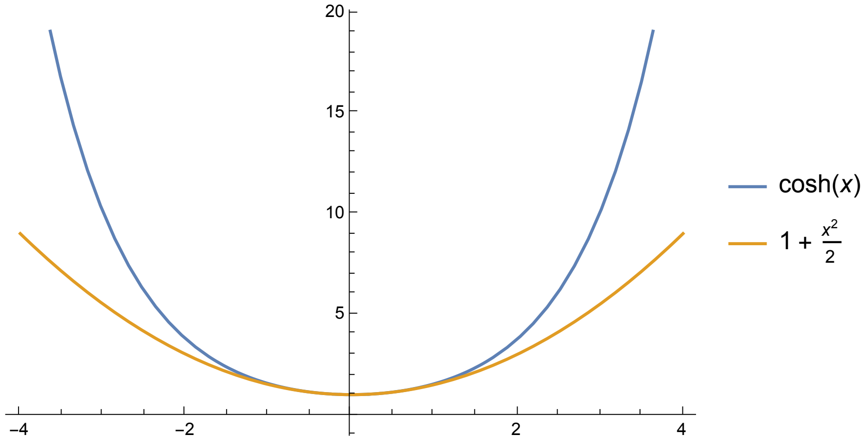
x == 6.40567 || x == 93.3545

Ques. 6

```
Normal[Series[Cosh[x], {x, 0, 2}]]
```

$$1 + \frac{x^2}{2}$$

```
Plot[{Cosh[x], 1 + x^2/2}, {x, -4, 4}, PlotLegends → "Expressions"]
```



In[401]:=
```
Abs[(1 + x^2/2 - Cosh[x])/Cosh[x] /. x → 0.5] // N
```

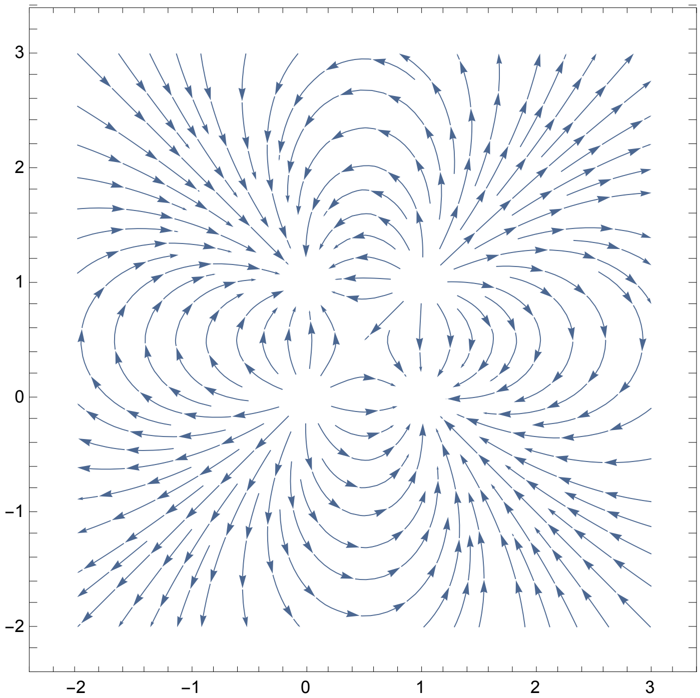
Out[401]= 0.00232876

In[402]:=
```
Abs[(1 + x^2/2 - Cosh[x])/Cosh[x] /. x → 1] // N
```

Out[402]= 0.0279186

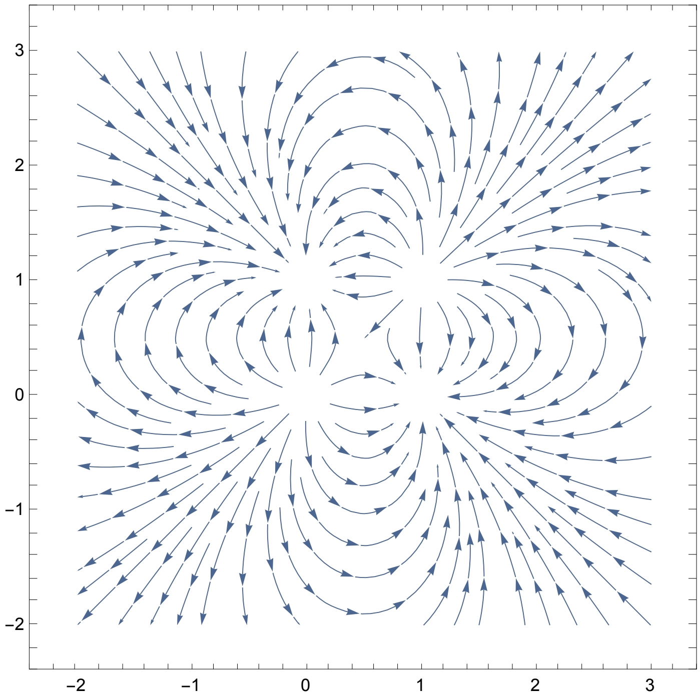
Ques. 7

```
fieldLines =
 StreamPlot[{x/r^3 - (x - 1)/r1^3 - x/r2^3 + (x - 1)/r3^3, y/r^3 - y/r1^3 - (y - 1)/r2^3 + (y - 1)/r3^3} /. r → Sqrt[x^2 + y^2] /.
     r1 → Sqrt[(x - 1)^2 + y^2] /. r2 → Sqrt[x^2 + (y - 1)^2] /. r3 → Sqrt[(x - 1)^2 + (y - 1)^2], {x, -2, 3},
   {y, -2, 3}, RegionFunction → Function[{x, y, vx, vy, n}, x^2 + y^2 > 0.05 &&
      (x - 1)^2 + (y - 1)^2 > 0.05 && (x)^2 + (y - 1)^2 > 0.05 && (x - 1)^2 + (y)^2 > 0.05]]
```

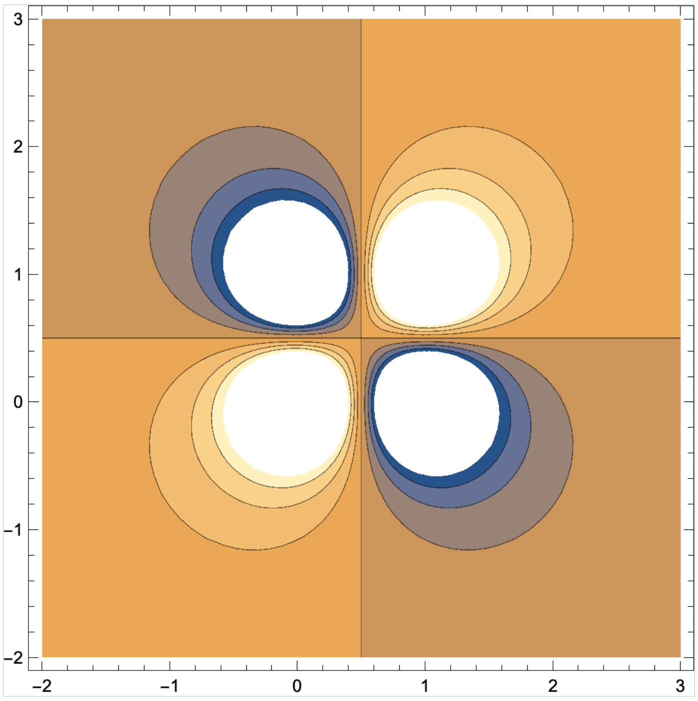


Alternatively,

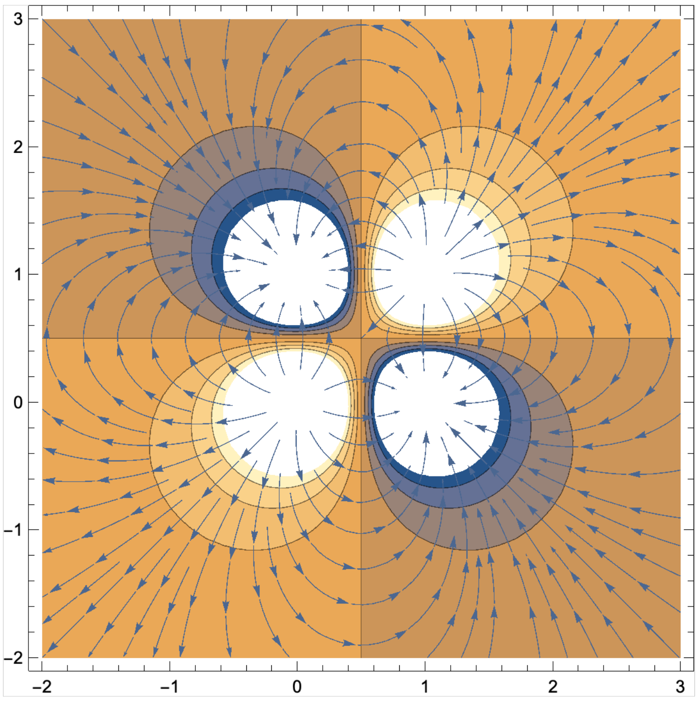
```
fieldLines =
 StreamPlot[{x/r^3 - (x - 1)/r1^3 - x/r2^3 + (x - 1)/r3^3, y/r^3 - y/r1^3 - (y - 1)/r2^3 + (y - 1)/r3^3} /. r -> Sqrt[x^2 + y^2] /.
    r1 -> Sqrt[(x - 1)^2 + y^2] /. r2 -> Sqrt[x^2 + (y - 1)^2] /. r3 -> Sqrt[(x - 1)^2 + (y - 1)^2],
  {x, -2, 3}, {y, -2, 3}, RegionFunction -> Function[{x, y, vx, vy, n}, n < 20]]
```



```
equiPotential = ContourPlot[
  {1/r - 1/r1 - 1/r2 + 1/r3} /. r → Sqrt[x^2 + y^2] /. r1 → Sqrt[(x - 1)^2 + y^2] /. r2 → Sqrt[x^2 + (y - 1)^2] /.
   r3 → Sqrt[(x - 1)^2 + (y - 1)^2], {x, -2, 3}, {y, -2, 3}]
```




```
Show[equiPotential, fieldLines]
```



Ques. 8

$$\texttt{StreamPlot}\left[\left\{\frac{1}{r^3}\left(2\,\frac{x^2}{r^2}-\frac{y^2}{r^2}\right),\ \frac{1}{r^3}\left(3\,\frac{x\,y}{r^2}\right)\right\}\ /.\ r\to\sqrt{x^2+y^2}\,,\ \{x,-4,4\},\ \{y,-4,4\},\ \texttt{RegionFunction}\to\texttt{Function}\left[\{x,y,vx,vy,n\},\ x^2+y^2>0.01\right]\right]$$