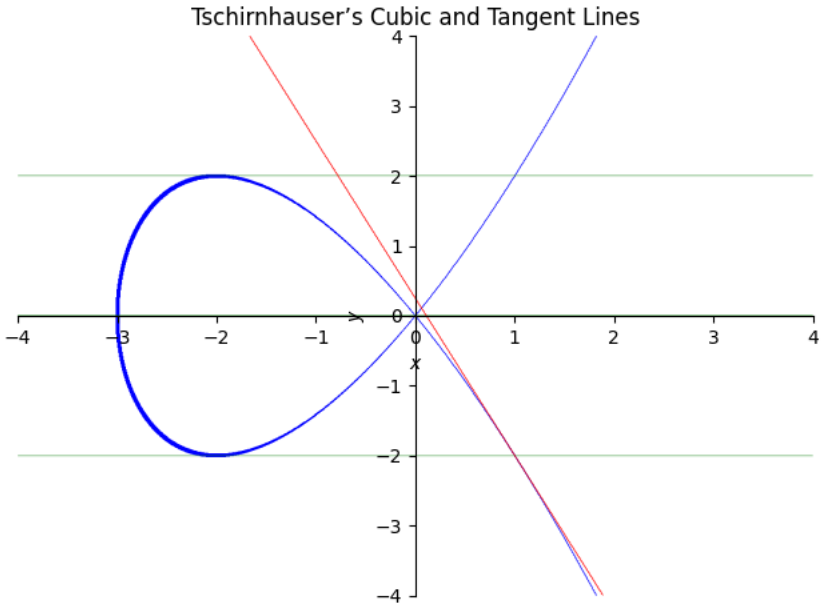


## Question 3

### 3a

```
#finds and simplifys log y
x = sp.symbols('x')
y = x**9 * (8 + x**2)**(1 - x**2)
log_y = sp.log(y)
log_y_simplified = sp.expand_log(log_y)
print("Log(y):")
print(log_y_simplified)
```

```
Log(y):
log(x**9*(x**2 + 8)**(1 - x**2))
```

### 3b

```
#finds the derivative of log y with respect to x
derivative_log_y = sp.diff(log_y_simplified, x)
print("\nDerivative of log(y):")
print(derivative_log_y)
```

```
Derivative of log(y):
(x**2 + 8)**(x**2 - 1)*(x**9*(x**2 + 8)**(1 - x**2)*(2*x*(1 - x**2)/(x**2 + 8) - 2*x*log(x**2 + 8)) + 9*x**8*(x**2 + 8)**(1 - x**2))/x**
```

### 3c

```
#finds the derivative of y
dy_dx_using_log = y * derivative_log_y
print("\nDerivative of y using log(y):")
print(dy_dx_using_log.simplify())
```

```
Derivative of y using log(y):
x**8*(2*x**2*(x**2 + 8)**(1 - x**2)*(-x**2 - (x**2 + 8)*log(x**2 + 8) + 1) + 9*(x**2 + 8)**(2 - x**2))/(x**2 + 8)
```

## 3d

```
#uses diff to find derivative of y
dy_dx_direct = sp.diff(y, x)
print("\nDirect derivative of y:")
print(dy_dx_direct.simplify())

#checks if derivative of log y and y are the same
are_equal = sp.simplify(dy_dx_using_log - dy_dx_direct) == 0
print("\nAre both derivatives equal?", are_equal)
```

```
Direct derivative of y:
x**8*(2*x**2*(x**2 + 8)**(1 - x**2)*(-x**2 - (x**2 + 8)*log(x**2 + 8) + 1) + 9*(x**2 + 8)**(2 - x**2))/(x**2 + 8)

Are both derivatives equal? True
```