

# Worksheet 01~05

In [1]: `%config IPCompleter.greedy=True`

In [2]: `from sympy import *  
from sympy.geometry.line import Line  
from sympy.plotting import plot, plot3d  
import matplotlib.pyplot as plt  
%matplotlib inline  
  
plt.rcParams['figure.figsize'] = 10, 10  
init_printing(use_unicode=True)  
x, y, a, b, k, K, A, B = symbols('x y a b k K A B')`

1. If  $a(x + 2) + b(x - 1) = 3$  for all  $x$ , then  $a =$

(A) -1 (B) 0 (C) 1 (D) 2 (E) 3

## Solution

### My work

$$a(x + 2) + b(x - 1) = 3$$

$$ax + 2a + bx - b = 3$$

$$(a + b)x + (2a - b) = 3$$

$$a + b = 0 \text{ or } 2a - b = 3$$

$$+ \begin{cases} a + b = 0 \\ 2a - b = 3 \end{cases}$$


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$$3a = 3$$

$$a = \frac{3}{3} = 1$$

$$b = -a = -1$$

$$\begin{cases} a = 1 \\ b = -1 \end{cases}$$

### Using SymPy

**Method 1**

```
In [3]: eq = Eq((a*(x+2))+b*(x-1), 3)
eq
```

```
Out[3]: a(x + 2) + b(x - 1) = 3
```

```
In [4]: solve(eq, a, b)
```

```
Out[4]: {a : 1,  b : -1}
```

**Method 2**

```
In [5]: solve(((a*(x+2))+b*(x-1)-3), a, b)
```

```
Out[5]: {a : 1,  b : -1}
```

**Answer: (C)**

2. If  $a + b = 2$  and  $ab = -1$ , then  $a^2 + b^2 =$

(A) 4 (B) 5 (C) 6 (D) 8 (E) 10

**Solution****My Work**

$$\begin{aligned}
 a^2 + b^2 &= a^2 + b^2 + 2ab - 2ab \\
 &= (a + b)^2 - 2ab \\
 &= 2^2 - 2(-1) \\
 &= 6
 \end{aligned}$$

**Using SymPy**

```
In [6]: expr = (a+b)*(a+b)-2*a*b
expr.subs([(a+b, 2), (a*b, -1)])
```

```
Out[6]: 6
```

**Answer: (C)**

3. C. If the graphs of  $3x + 4y = 5$  and  $kx + 2y = 5$  are perpendicular, then  $k =$

(A) -2 (B) -2.67 (C) 2.15 (D) 3.20 (E) 4

## Solution

### My Work

- Set  $slop_1$  for  $\ell_1: 3x + 4y = 5$

$$3x + 4y = 5$$

$$y = \frac{-3x + 5}{4} = -\frac{3}{4}x + \frac{5}{4}$$

$$slop_1 = -\frac{3}{4}$$

- Set  $slop_2$  for  $\ell_2: kx + 2y = 5$

$$kx + 2y = 5$$

$$y = \frac{-kx + 5}{2} = -\frac{k}{2}x + \frac{5}{2}$$

$$slop_2 = -\frac{k}{2}$$

- $\ell_1$  and  $\ell_2$  are perpendicular, it means  $slop_1 * slop_2 = -1$

$$\left(-\frac{3}{4}\right) * \left(-\frac{k}{2}\right) = -1$$

$$k = -\frac{2 * 4}{3} = -\frac{8}{3} \approx -2.67$$

### Using SymPy

```
In [7]: result = solve((-3/4)*(-k/2)+1, k)
result[0].evalf(3)
```

```
Out[7]: -2.67
```

## Answer: (B)

4. If  $K = \frac{AB}{A+B}$ , then  $B =$

- (A)  $\frac{A}{1-A}$
- (B)  $\frac{AK}{A-K}$
- (C)  $\frac{AK}{K-A}$
- (D)  $\frac{A+K}{A}$
- (E)  $\frac{A-K}{AK}$

## Solution

### My Work

$$K = \frac{AB}{A+B}$$

$$K(A+B) = AB$$

$$KA + KB = AB$$

$$KA = (A-K)B$$

$$(A-K)B = KA$$

$$B = \frac{KA}{A-K}$$

### By SymPy

In [8]: `solve(Eq(K, (A*B)/(A+B)), B)`

Out[8]:  $\left[ \frac{AK}{A-K} \right]$

## Answer: (B)

5. If  $\log 3 = a$ , then  $\log 90 =$

- (A)  $1 + 2a$
- (B)  $10a^2$
- (C)  $10 + 2a$
- (D)  $30a$
- (E)  $10 + 3a$

## Solution

### My Work

$$\begin{aligned}\log 90 &= \log (9 \times 10) \\ &= \log (9) + \log (10) \\ &= \log 3^2 + 1 \\ &= 2 \log 3 + 1 \\ &= 2a + 1\end{aligned}$$

### By SymPy

```
In [9]: expr = 2*log(3)+1  
        expr.subs(log(3), a)
```

```
Out[9]: 2a + 1
```

### Answer: (A)

```
In [ ]:
```