Question 1:

An arithmetic sequence has a common difference of -7. If the first term is 50, what is the 15th term?

The n-th term of an arithmetic sequence is given by:

$a_n = a + (n - 1)d$

where:

- a is the first term,
- d is the common difference,
- n is the term number.

Given:

- $a = 50$,
- $d = -7$,
- $n = 15$.

Substitute these values into the formula:

$a_{15} = 50 + (15 - 1)(-7)$

$a_{15} = 50 + 14(-7)$

$a_{15} = 50 - 98$

$a_{15} = -48$

So, the 15th term is -48.

Question 2:

Find the coefficient of x^5 in the expansion of $(2x+3)^8$ using the binomial theorem.

The binomial theorem states:
$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k$

We need to find the term containing x^5 in the expansion of $(2x+3)^8$.

Here, $a = 2x$ and $b = 3$, and we need the term where the power of x is 5. So, we need:
$(2x)^5 \cdot 3^{8-5} = (2x)^5 \cdot 3^3$

The general term in the expansion is given by:
$\binom{8}{k}(2x)^{8-k}3^k$

Setting $8 - k = 5$:
$k = 3$

Thus, the required term is:
$\binom{8}{3}(2x)^5 3^3$
$= \binom{8}{3} 2^5 x^5 3^3$

Calculate each part:
$\binom{8}{3} = \frac{8!}{3!(8-3)!} = \frac{8!}{3!5!} = 56$
$2^5 = 32$
$3^3 = 27$

So, the coefficient of x^5 is:
$56 \times 32 \times 27 = 48384$

Question 3:

Write the equation $2x - 3y = 6$ in slope-intercept form and determine its slope and y-intercept.

The slope-intercept form of a line is:

$y = mx + b$

where:

- m is the slope,
- b is the y-intercept.

Starting from:

$2x - 3y = 6$

Solve for y:

$-3y = -2x + 6$

$y = \frac{2}{3}x - 2$

So, the equation in slope-intercept form is:

$y = \frac{2}{3}x - 2$

Here:

- The slope (m) is $\frac{2}{3}$.
- The y-intercept (b) is -2.

Question 4:

A point $P(x, y)$ on the unit circle makes an angle θ with the positive x-axis. If $\theta = 120^\circ$, find the coordinates of P.

For a point on the unit circle at an angle θ:
$x = \cos\theta$
$y = \sin\theta$

Given $\theta = 120^\circ$:
$\cos 120^\circ = -\frac{1}{2}$
$\sin 120^\circ = \frac{\sqrt{3}}{2}$

Therefore, the coordinates of P are:
$P\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$