Q1.

$2y - 3(x - 4) - y$

Distribute the -3 into the parentheses

$2y - 3x + 12 - y$

$y - 3x + 12$

So, the simplified expression is: $y - 3x + 12$

Q2.

$-3^2 + 3^2$

$9 + 9 = 18$

So, the value of the expression is 18

Q3.

$(2x - 5)(x + 3) = 0$

To find the solutions, you can set each factor equal to zero and solve for x.

$2x - 5 = 0$

$2x = 5$

$x = \frac{5}{2}$

$x + 3 = 0$

$x = -3$

$So, the\ solutions\ for\ the\ equation\ (2x - 5)(x + 3) = 0\ are\ x = \frac{5}{2}\ and\ x = -3$

Q4.

$A \cup (A \cap B \cap C)$

Q5.

To find the equation of a straight line passing through the points (3, 4) and (7, 12), we can use the point-slope form of a linear equation, which is given by:

$y - y1 = m(x - x1)$

where $(x1, y1)$ is one of the points on the line and m is the slope of the line.

First, we find the slope (m) using the given points (3, 4) and (7, 12):

$$m = \frac{(y2 - y1)}{(x2 - x1)}$$

Using the points $(3, 4)$ as $(x1, y1)$ and $(7, 12)$ as $(x2, y2)$, we get:

$$m = \frac{(12 - 4)}{(7 - 3)} = \frac{8}{4} = 2$$

Now that we have the slope $(m = 2)$, we can use the point-slope form and plug in one of the points. Let's use $(3, 4)$ as $(x1, y1)$:

$y - 4 = 2(x - 3)$

Now, let's solve for y:

$y - 4 = 2x - 6$

$y = 2x - 6 + 4$

$y = 2x - 2$

The equation of the straight line passing through the points (3, 4) and (7, 12) is $y = 2x - 2$.

Q6.

$3x^3 - 12xy^2$

First look for the greatest common factor (GCF) of the terms. In this case, the GCF is $3x$:

$3x^3 - 12xy^2 = 3x(x^2 - 4y^2)$

Now, notice that the expression in the parentheses is a difference of squares:

$x^2 - 4y^2 = (x + 2y)(x - 2y)$

So, the factored expression is:

$3x^3 - 12xy^2 = 3x(x + 2y)(x - 2y)$

Q7.

(a) To find the transpose of matrix M, you simply switch the rows and columns.

Given matrix M:

$$M = \begin{pmatrix} -2 & 3 \\ 4 & -2 \end{pmatrix}$$

The transpose of matrix M (denoted as M^T) is:

$$M^T = \begin{pmatrix} -2 & 4 \\ 3 & -2 \end{pmatrix}$$

(b) Given matrices P and Q:

$$P = \begin{pmatrix} 2 & -1 \\ 0 & 3 \end{pmatrix} \quad and \quad Q = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

Matrix multiplication is only possible if the number of columns in the first matrix is equal to the number of rows in the second matrix. In this case, P has 2 columns and Q has 2 rows, so we can multiply them.

To find PQ, perform the following multiplications and additions:

$$PQ = \begin{pmatrix} 2(-1) + (-1)(3) \\ 0(-1) + 3(3) \end{pmatrix} = \begin{pmatrix} -2 - 3 \\ 0 + 9 \end{pmatrix} = \begin{pmatrix} -5 \\ 9 \end{pmatrix}$$

So, the product of matrices P and Q is:

$$PQ = \begin{pmatrix} -5 \\ 9 \end{pmatrix}$$

Q8.

(a) Since the universal set E contains the first 8 whole numbers, we have:

E = {0, 1, 2, 3, 4, 5, 6, 7}

Now, we need to list the even numbers in set A. Even numbers are those that are divisible by 2. From the universal set E, we can see that the even numbers are:

A = {0, 2, 4, 6}

(b) To find out how many shares the businesswoman was able to buy, we need to divide

the total amount of money she had by the cost per share.

The businesswoman had K9,100.00, and the cost per share was K1.30. So, the number of shares she could buy is:

$$Number\ of\ shares\ =\ \frac{Total\ amount}{Cost\ per\ share}$$

$$Number\ of\ shares\ =\ \frac{K9{,}100}{K1.30}$$

$$Number\ of\ shares\ =\ \frac{9100}{1.30}$$

Number of shares = 7000

The businesswoman was able to buy 7,000 shares.

Q9

(a) Let's denote the first term of the arithmetic progression as a and the common difference as d. We are given that the third term is 6 and the fourth term is 3.

The formula for the nth term of an arithmetic progression is:

$$an\ =\ a\ +\ (n\ -\ 1)d$$

Using the given information, we can set up two equations:

For the third term (n = 3):

$$a\ +\ 2d\ =\ 6$$

For the fourth term (n = 4):

$a + 3d = 3$

Now, we can solve these equations to find the first term a and the common difference d. We can subtract the first equation from the second one to eliminate a:

$(a + 3d) - (a + 2d) = 3 - 6$

3d - 2d = -3

d = -3

Now that we have the common difference d, we can substitute it back into the equation for the third term:

a + 2(-3) = 6

a - 6 = 6

a = 12

So the first term (a) of the arithmetic progression is 12.

(b) Now that we have the first term (a) and the common difference (d) for the arithmetic progression, we can create a formula for the nth term.

Recall that the formula for the nth term of an arithmetic progression is:

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

Given that a = 12 and d = -3, we can plug these values into the formula:

$an = 12 + (n - 1)(-3)$

This formula represents the nth term of the arithmetic progression:

$an = 12 - 3(n - 1)$

Q10

(a) The probability of getting a black button from a box is $\frac{2}{9}$

This means that the probability of getting a button that is not black is:

$1 - \frac{2}{9} = \frac{7}{9}$

(b) To calculate the value of θ, we need to use the formula for the area of a sector, which is:

$$Area\ of\ sector = (\frac{\theta}{360})\pi r^2$$

$In\ this\ problem, we\ know\ that\ the\ area\ of\ the\ sector\ is\ 462\ cm^2, the\ radius\ is\ 21\ cm,$

$and\ \pi\ = \frac{22}{7}. Therefore, we\ can\ solve\ for\ the\ angle\ as\ follows:$

$$462\ = \left(\frac{\theta}{360°}\right) \times \left(\frac{22}{7}\right) \times 21^2$$

$$462\ = \left(\frac{\theta}{360°}\right) \times\ 1386$$

$$\theta\ = \frac{(462\ \times\ 360°)}{1386}$$

$$\theta\ =\ 120°$$

Q11

(a) Distance = 4500 nautical miles

Time = 5 hours

$$Speed\ = \frac{Distance}{Time}$$

$$Speed\ = \frac{4500}{5} = 900\ knots$$

(b) Town C is 5 hours ahead of town A.

1 hour = 15 degrees longitude

5 hours * 15 degrees/hour = 75 degrees

Town A is at 25°W. Town C is east of town A (ahead in time).

Longitude of town C = 25°W + 75° = 50°E

Q12

(a) Absolute error = |Measured value - Actual value|

= |2.2 cm - 2 cm|

= 0.2 cm

(b) Percentage error = Absolute error / Actual value * 100%

= 0.2 cm / 2 cm * 100%

= 10%

Q13

(a) $A\hat{D}C = 360° - 126°$

$= 234°$

$= 117°$

(b) $O\hat{C}D = 180° - 126°$

$= 54°$

(c) $B\hat{A}O = 360° - 213° - 117°$

$= 30°$

Q14

(a) K form L = 90° – 30°

= 060°

(b) J form L = 360° – 20°

= 340°

Q15

(a) $f(x) = \frac{x+9}{2}$

$$y = \frac{x+9}{2}$$

$$x + 9 = 2y$$

$$x = 2y - 9$$

$$f^{-1}(x) = 2x - 9$$

(b) $f(x) = x + 9, g(x) = x - 2$

$$fg(x) = \frac{x-2+9}{2}$$

$$fg(x) = \frac{x-2+9}{2}$$

$$fg(x) = \frac{x+7}{2}$$

(c) $fg(-5) = \frac{-5+7}{2} = \frac{2}{2} = 1$

Q16

(a) $2y - x = 3$

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

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

$$M_1 = \frac{1}{2}$$

$$M_2 = -2$$

$y = mx + c$

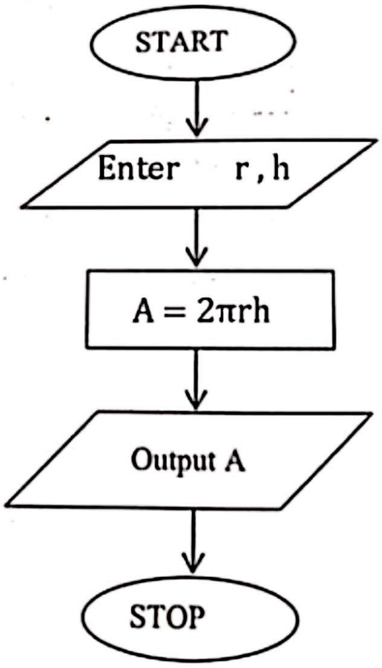
$1 = -2(-4) + C$

$1 = 8 + C$

$C = -7$

$y = -2x - 7$

(b)



Q17

(a) Rotation symmetry with order of 2

(b) Reflection at $y = -x$

Q18

(a) $y = \frac{2x}{z^2}k$

$y = \frac{2(8)}{z^2}k$

$4 = \frac{2(8)}{2^2}k$

$4 = \frac{16}{4}k$

$4 = 4k$

$K = 1$

(b) $y = \frac{2x}{z^2}$

$y = \frac{2(27)}{3^2}$

$y = \frac{54}{9}$

$y = 6$

(c) $y = \frac{2x}{z^2}$

$3 = \frac{2(24)}{z^2}$

$3z^2 = 2 \times 24$

$z^2 = 16$

$Z = \sqrt{16}$

$Z = 4 \quad or \quad Z = -4$

Q19

(a) $\int(6x^2 - 2x + 7)dx$

$$\frac{6x^2}{3} - \frac{2x^2}{2} + 7x + C$$

$$2x^3 - x^2 + 7x + C$$

(b) Since the cylinders are similar:

$$\frac{A_1}{A_2} = \left(\frac{h_1}{h_2}\right)^2$$

Solve for h_2:

$$\frac{64}{36} = \left(\frac{30}{h_2}\right)^2$$

$$\left(\frac{30}{h_2}\right)^2 = \frac{64}{36}$$

$$\frac{30}{h_2} = \frac{8}{6}$$

$$h_2 = \frac{30 \times 6}{8}$$

$$h_2 = \frac{180}{8}$$

$$h_2 = 22.5cm$$

The height of the smaller cylinder is $22.5cm$

Q20

(a) Use the Pythagorean theorem for triangle ABC to find AC

$$AC = \sqrt{AB^2 + BC^2}$$

$$AC = \sqrt{3^2 + 4^2}$$

$$AC = \sqrt{9 + 16}$$

$$AC = \sqrt{25}$$

$$AC = 5cm$$

Triangle ACD is also a right triangle, so use $tan\ D\hat{A}C$.

$$tan\ D\hat{A}C = \frac{AC}{AD}$$

$$tan\ D\hat{A}C = \frac{5}{13}$$

(b) Given:

A is the point (1, 2)

B is the point (-2, 5)

$$\overrightarrow{AB} = \begin{pmatrix} -2 & -1 \\ 5 & -2 \end{pmatrix} = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$$

Q21

Finding the slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{8-4}{0-6} = -\frac{4}{6} = -\frac{2}{3}$$

$$y - 8 = -\frac{2}{3}(x - 0)$$

$$y - 8 = -\frac{2}{3}x$$

$$y = -\frac{2}{3}x + 8$$

So, the inequality for this line is:

$$y = -\frac{2}{3}x + 8$$

Therefore, the three inequalities defining the region R are:

$$x \geq 0$$

$$y \leq x$$

$$y = -\frac{2}{3}x + 8$$

Q22

(a) $\sqrt{2} = 2^x$

$(\sqrt{2})^2 = (2^x)^2$

$2 = 2^{2x}$

$\frac{1}{2} = \frac{2x}{2}$

$x = \frac{1}{2}$

(b) (i) Coordinates of A and B:

$y = 0$ for x-axis intersections

$0 = (-x + 2)(x - 5)$

Solve for x:

$x = 5 \ and \ x = 2$

Coordinates

$A(2,0) \ and \ B(5,0)$

(ii) Maximum value of y:

Vertex form of parabola:

$y = a(x - h)^2 + k$

Vertex (h, k) is midpoint between A and B:

$h = \frac{2 + 5}{2} = 3.5$

Substitute $h = 3.5$ into equation to find k:

$y = (-x + 2)(x - 5)$

$y = -(3.5 - 2)(3.5 - 5)$

$y = -(1.5)(-1.5)$

$k = 2.25$

Maximum value of y: $y = 2.25 \ at \ x = 3.5$

Q22

(a) To find the acceleration at $t = 3$ seconds:

$$a = \frac{24 - 4}{5 - 0}$$

$$a = \frac{20}{5}$$

$$a = 4m/s^2$$

(b) To find the time t when deceleration is $2m/s^2$

$$-a = \frac{v - u}{t}$$

$$-2 = \frac{0 - 24}{t}$$

$$-2t = -24$$

$$t = 12\ seconds$$

(c) To calculate the average speed for the first 10 seconds:

$$A = (l \times b) + \frac{1}{2} \times (a + b)h$$

$$A = (5 \times 24) + \frac{1}{2} \times (4 \times 24)5$$

$$A = 120 + 70$$

$$A = 190m$$

$$v_{avg} = \frac{190}{10}$$

$$v_{avg} = 19m/s$$