Q1(1):

By completing the square, $2x^2-5x=2(x-\frac{5}{4})^2-\frac{25}{8}$. Therefore, when $x=\boxed{\dfrac{5}{4}}$, the expression takes its minimum $\boxed{-\dfrac{25}{8}}$.

On the other hand, as the graph of the expression convex downwards, the further the value of x from $\frac{5}{4}$, the greater the value of the expression. Therefore, the expression takes it maximum when $x=\boxed{4}$ and the value is $32-20=\boxed{12}$.

Q1(2):

Note that the outcome of A's coin and the outcome of B's come at each round are independent. Therefore, the required probability is equal to the probability that the number of head that A got after three tosses is greater than that of B. Denote the numbers by the ordered pair (A,B), we can exhaust all the cases:

$(A,B)=(1,0),(2,0),(3,0),(2,1),(3,1),(3,2)$

Therefore, the probability=

$(1-(\frac{1}{2})^3)(\frac{1}{2})^3+(C^3_1(\frac{1}{2})^2(\frac{1}{2})+(\frac{1}{2})^3)(C^3_1(\frac{1}{2})(\frac{1}{2})^2)+(\frac{1}{2})^3(C^3_2(\frac{1}{2})^2(\frac{1}{2}))$

$=\frac{7}{64}+\frac{3}{16}+\frac{3}{64}$

$=\boxed{\dfrac{11}{32}}$.

Q1(3):

$\frac{a}{b}+\frac{b}{a}=\frac{a^2+b^2}{ab}$

$=\frac{(a+b)^2}{ab}-2$

$= \frac{(2\sqrt{5})^2}{5-3} - 2$

$= \boxed{8}$.

Alternative $\frac{a}{b} + \frac{b}{a} = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} + \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$

$= \frac{8+2\sqrt{15}}{2} + \frac{8-2\sqrt{12}}{2}$

$= \boxed{8}$.

Q1(4):

By De Morgan's law, $\neg(x \neq 0 \wedge y \neq 0) = (\boxed{x = 0 \vee y = 0})$.

Q1(5):

Denote the two circles as C_1 and C_2 and let the points of tangent of them be $(0, y_1)$ and $(0, y_2)$ respectively.

As they are tangent to the y-axis, the y-coordinates of their centres are equal to that of their points of tangent and the x-coordinates of their centres are equal to their radii.

Then, we have the equation of the two circles:

$C_1 : (x-a)^2 + (y-y_1)^2 = a^2$

$C_2 : (x-b)^2 + (y-y_2)^2 = b^2$

As they pass through points $(1, 3)$ and $(2, 4)$, by substituting the coordinates into their equations respectively, we have:

$$\begin{cases}(1-r)^2+(3-\lambda)^2=r^2 \\ \\ (2-r)^2+(4-\lambda)^2=r^2\end{cases}.$$

By symmetry, the two solutions of (r,λ) are (a,y_1) and (b,y_2).

Combine the two equations, we have

$$(1-r)^2+(3-\lambda)^2=(2-r)^2+(4-\lambda)^2$$

$$-(3-2r)=7-2\lambda$$

$$\lambda=5-r$$

Substitue this relation into the first equation, we have $(1-r)^2+(r-2)^2=r^2$, i.e. $r^2-6r+5=0$.

Now, we are going to find ab, which is the product of roots of this quadratic equation, we have $ab=\frac{5}{1}=\boxed{5}$.

Q1(6):

We split the equation into three pieces:

$$\begin{cases}2x-1+x-2=2 \\ \\ x\geq 2\end{cases} \text{ or } \begin{cases}2x-1-x+2=2 \\ \\ \frac{1}{2}\leq x\leq 2\end{cases} \text{ or } \begin{cases}-2x+1-x+2=2 \\ \\ x\leq \frac{1}{2}\end{cases}.$$

Solving each, we have two solutions $x=1$ and $x=\frac{1}{3}$.

Therefore, the minimum solution is $\boxed{\dfrac{1}{3}}$ and the maximum solution is $\boxed{1}$.

Q1(7):

Rewrite $\omega = \sin 30° + i\cos 30°$.

By De Moivre's theorem, $\omega^5 = \sin 150° + i\cos 150° = \boxed{\frac{1}{2}} + \boxed{-\frac{\sqrt{3}}{2}}i$.

Alternative Note that ω is a root of $x^2 - x + 1 = 0$*. Then, we have $\omega^5 = \omega^4 - \omega^3$

$= (\omega^3 - \omega^2) - \omega^3$

$= -(\omega - 1)$

$= 1 - \frac{1+\sqrt{3}i}{2}$

$= \boxed{\frac{1}{2}} + \boxed{-\frac{\sqrt{3}}{2}}i$.

(*: Suppose ω is a root of a quadratic equation, then its conjugate is also a root. Therefore we have the sum of roots=1 and the product of roots=1 and the quadratic equation can hence be constructed.)

Alternative ω is the 3rd primitive root of unity, where $\omega^2 = \bar{\omega}$ and $\omega^3 = 1$. Therefore, we have $\omega^5 = \bar{\omega} = \boxed{\frac{1}{2}} + \boxed{-\frac{\sqrt{3}}{2}}i$.

Q1(8):

Solve the recurrence using telescoping:

$$\sum_{i=1}^{n}(a_{i+1} - a_i) = \sum_{i=1}^{n}(2i)$$

$$a_{n+1} - a_1 = n(n+1)$$

$$a_n = \boxed{(n-1)n}$$

Q2:

(1): The angle at the centre is twice the angle at the circumference. Therefore, we have $\angle COB = 2a$, $\angle AOC = 2b$ and $\angle BOA = 2c$.

Suppose a, b, c are in radian measure*. Then, by definition, we have $AB = \boxed{2cr}$, $BC = \boxed{2ar}$ and $CA = \boxed{2br}$.

(*: The question did not state it clearly, but otherwise the answers will become $\frac{c}{90^\circ}r$ etc., which do not match the official answer key.)

(2): Suppose $\triangle ABC$ is an acute-angle triangle*.

Then, the area of $\triangle ABC = \triangle AOC + \triangle BOC + \triangle COA$

$= \frac{1}{2}(r)(r)\angle AOC + \frac{1}{2}(r)(r)\angle BOC + \frac{1}{2}(r)(r)\angle COA$

$= \frac{r^2}{2}(\sin\boxed{2a} + \sin\boxed{2b} + \sin\boxed{2c})$.

(*: Again, the question did not state it clearly, otherwise the formula will not necessarily hold. A counter example is the $30^\circ - 30^\circ - 120^\circ$ triangle.)

(3): By the sine formular, we have $\frac{AB}{\sin c} = \frac{BC}{\sin a} = \frac{AC}{\sin b} = 2r$.

Therefore, $AB = 2\sin 45^\circ = \boxed{\sqrt{2}}$.

$BC = 2\sin 75^\circ = 2(\sin 45^\circ \cos 30^\circ + \sin 30^\circ \cos 45^\circ)$

$= 2(\frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4})$

$= \boxed{\dfrac{\sqrt{2}+\sqrt{6}}{2}}$.

$CA = 2\sin 60^\circ = \boxed{\sqrt{3}}$.

Q3:

By the fundamental theorem of calculus, we have $f(x) = (3x^2 + (a+8)x + 4)' =$

$6x + (a+8)$. Substitue it back to the equation, we have

$$\int_a^x (6t + (a+8))dt = 3x^2 + (a+8)x + 4$$

$$[3t^2 + (a+8)t]_a^x = 3x^2 + (a+8)x + 4$$

$$3x^2 + (a+8)x - 3a^2 - a(a+8) = 3x^2 + (a+8)x + 4$$

Compare the constant term, we have

$$-3a^2 - a(a+8) = 4$$

$$a^2 + 2a + 1 = 0$$

$$a = \boxed{-1}$$

Therefore, $f(x) = \boxed{6x+7}$ and $\int_a^x f(t)dt = 3x^2 + 7x + 4$.

To find the extremum, we set $(\int_a^x f(t)dt)' = 0$, then we have $x = -\frac{7}{6}$. As $(\int_a^x f(t)dt)'' = 6 > 0$, the extremum is a minimum. Therefore, the minimum of the integral obtained when $x = -\frac{7}{6}$, and the corresponding value is $\boxed{-\dfrac{1}{12}}$.

Alternative By the fundamental theorem of calculus, we have $\int_a^x f(t)dt = g(x) - g(a)$, where $g(x)$ is a primitive function of $f(x)$. By taking the constant term of $g(x)$ as 0, we have $g(x) = 3x^2 + (a+8)x$ and hence $-g(a) = -3a^2 - a(a+8)$. Therefore, we have the equation $-3a^2 - a(a+8) = 4$.