1. a. $\sin\left(\cos^{-1}(x)\right) = \sin(\theta) = \sqrt{1-x^2}$

b. $C = \cos^{-1}\left(\dfrac{a^2+b^2-c^2}{2ab}\right)$

c.
$$\begin{aligned}\tfrac{1}{2}ab\sin C &= \tfrac{1}{2}ab\sin\left(\cos^{-1}(C)\right)\\ &= \tfrac{1}{2}ab\sqrt{1-\left(\dfrac{a^2+b^2-c^2}{2ab}\right)}\\ &= \cdots\\ &= \sqrt{\dfrac{(a+b+c)(a+b-c)(a+c-b)(b+c-a)}{16}}\\ &= \cdots\end{aligned}$$

2. a. look on your calculator using the equations in part **b**
[Note: problem doesn't say which way the merry-go-round is spinning but it matters for the equations.**]**

b. **CW:** $y(t) = 18\cos\left(\dfrac{2\pi}{30}(t+5)\right)+25$ **CCW:** $y(t) = 18\cos\left(\dfrac{2\pi}{30}(t-5)\right)+25$

c. **CW:** $y(t) = -18\sin\left(\dfrac{2\pi}{30}(t-2.5)\right)+25$ **CCW:** $y(t) = 18\sin\left(\dfrac{2\pi}{30}(t+2.5)\right)+25$

d. **CW:** $10 + 30n$ **CCW:** $20 + 30n$

e. $y(t) = 27\cos\left(\dfrac{2\pi}{40}\left(t-\dfrac{20}{3}\right)\right)+32 = 27\sin\left(\dfrac{2\pi}{40}\left(t+\dfrac{10}{3}\right)\right)+32$

Finding $x(t)$ is slightly more difficult but pretend there is a line vertically down the middle of the diagram. You a finding the distance to that line.

$x(t) = 27\cos\left(\dfrac{2\pi}{40}\left(t+\dfrac{10}{3}\right)\right) = -27\sin\left(\dfrac{2\pi}{40}\left(t-\dfrac{20}{3}\right)\right)$.

Using the distance formula brings the equation for the distance of the boy from his mother.

$d(t) = \sqrt{\left(x(t)\right)^2+\left(y(t)\right)^2}$