Note: The actual exam will be shorter.

1. (15 points) Determine the amplitude, period, and phase shift of $y = 4 \sin(2x - \frac{2\pi}{3})$. Then graph the function.
2. (10 points) Use the right triangle shown in the picture to find b, c, and B. We know that $b = 5, B = 60^\circ$. You need to use trigonometric functions for this question, other methods will be disregarded.

3. (20 points)

(a) (3 points) Find the exact value of $\cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$. Explain your answer.

(b) (3 points) Find the exact value of $\sin(\sin^{-1}(-2\pi))$. 
(c) (4 points) Find the exact value of $\sin^{-1} \left( \sin \left( \frac{5\pi}{6} \right) \right)$. Explain your answer.

(d) (5 points) Find the exact value of $\tan \left( \sin^{-1} \left( -\frac{4}{5} \right) \right)$.

(e) (5 points) Find the exact value of $\sin(75^\circ)$.
(a) (5 points) Verify the identity \[ \cos \theta \cdot \csc \theta \cdot \tan \theta = 1 \]

(b) (10 points) Verify the identity

\[ \frac{\sec(2\theta) - \cos(2\theta)}{\sin^2(2\theta)} = \sec(2\theta) \]
(15 points) Given that $\sin(\alpha) = \frac{4}{5}$, $\alpha$ lies in quadrant I, and $\sin(\beta) = \frac{3}{5}$, $\beta$ lies in quadrant II. Find the exact value of $\sin(\alpha - \beta)$.

(10 points) Verify the identity

$$(\sin \theta - \cos \theta)^2 = 1 - \sin 2\theta$$
(a) (10 points) Find the value of $2 + \sin^2(75^\circ) + \sin^2(15^\circ)$. Explain your answer.

(b) (10 points) Use the reference angle to find the exact value of $\sin(-135^\circ)$. Explain your answer.

(Bonus 5 points) Find the exact value of

$$\cos^2(22.5^\circ) - \sin^2(22.5^\circ)$$
(a) (10 points) Solve the equation over the interval $[0, 2\pi)$

$$\cos(2x) = \frac{\sqrt{2}}{2}$$

(b) (15 points) Solve the following equation on the interval $[0, 2\pi)$

$$\sin x \cdot \cos x = -\frac{\sqrt{3}}{4}$$