1. Find the length of the curve:

$$(x(t), y(t)) = \left(\frac{t^2}{2}, \frac{1}{3}(2t+1)^{\frac{3}{2}}\right), \ 0 \le t \le 4.$$

(A) 12 (B) 13 (C) 14 (D) 15 (E) 16

2. For what values of x does the series $\sum_{n=0}^{\infty}(4x^2)^n$ converge absolutely.

(A) $|x| < \frac{1}{2}$ (B) $|x| < 1$ (C) $|x| < 4$ (D) $|x| < 2$ (E) $|x| < \frac{1}{4}$

3. The degree 5 term of the Maclaurin series for $\cos(x)\cos(x^2)$ is:
(Hint: Expand first the factors as a Maclaurin series).

(A) 0 (B) $-\frac{1}{720}$ (C) $\frac{1}{720}$ (D) $\frac{7}{720}$ (E) $-\frac{7}{720}$

4. Suppose we compute an approximation value for $(1.2)^{\frac{7}{2}}$ by using the second order Taylor polynomial for $f(x) = x^{\frac{7}{2}}$ at $a = 1$. According to Taylor's theorem the size of the error in the approximation is:

(A) $\frac{7}{400}\sqrt{c}$ where $1 \leq c \leq 1.2$ (B) $\frac{21}{200}\sqrt{c}$ where $1 \leq c \leq 1.2$ (C) $\frac{7}{400}\sqrt{c}$ where $0 \leq c \leq 0.2$

(D) $\frac{21}{200}\sqrt{c}$ where $0 \leq c \leq 0.2$ (E) $\frac{21}{200}c^{1.5}$ where $0 \leq c \leq 0.2$

5. Find the area of the surface generated by revolving the circle $(x(t), y(t)) = (\cos(t), 5 + \sin(t))$, $0 \leq t \leq 2\pi$, around the x-axis.

(A) $20\pi^2$ (B) $5\pi^2$ (C) $10\pi^2$ (D) π^2 (E) $4\pi^2$

6. Compute the Eccentricity of the Hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$

(A) $\frac{5}{4}$ (B) 5 (C) $\frac{\sqrt{7}}{4}$ (D) $\frac{\sqrt{7}}{3}$ (E) $\frac{5}{3}$

7. The polar equation $r = -8\cos(\theta)$, where $r \geq 0$ and $0 \leq \theta \leq 2\pi$, is the same as the cartesian equation:

(A) $x^2 + 8x + y^2 = 0$ (B) $(x-4)^2 + y^2 = 16$ (C) $(x+4)^2 + y^2 = 8$

(D) $(x-4)^2 + y^2 = 8$ (E) $x^2 - 8x + y^2 - 8 = 0$

8. (12 pts) Find a series solution for the initial value problem:

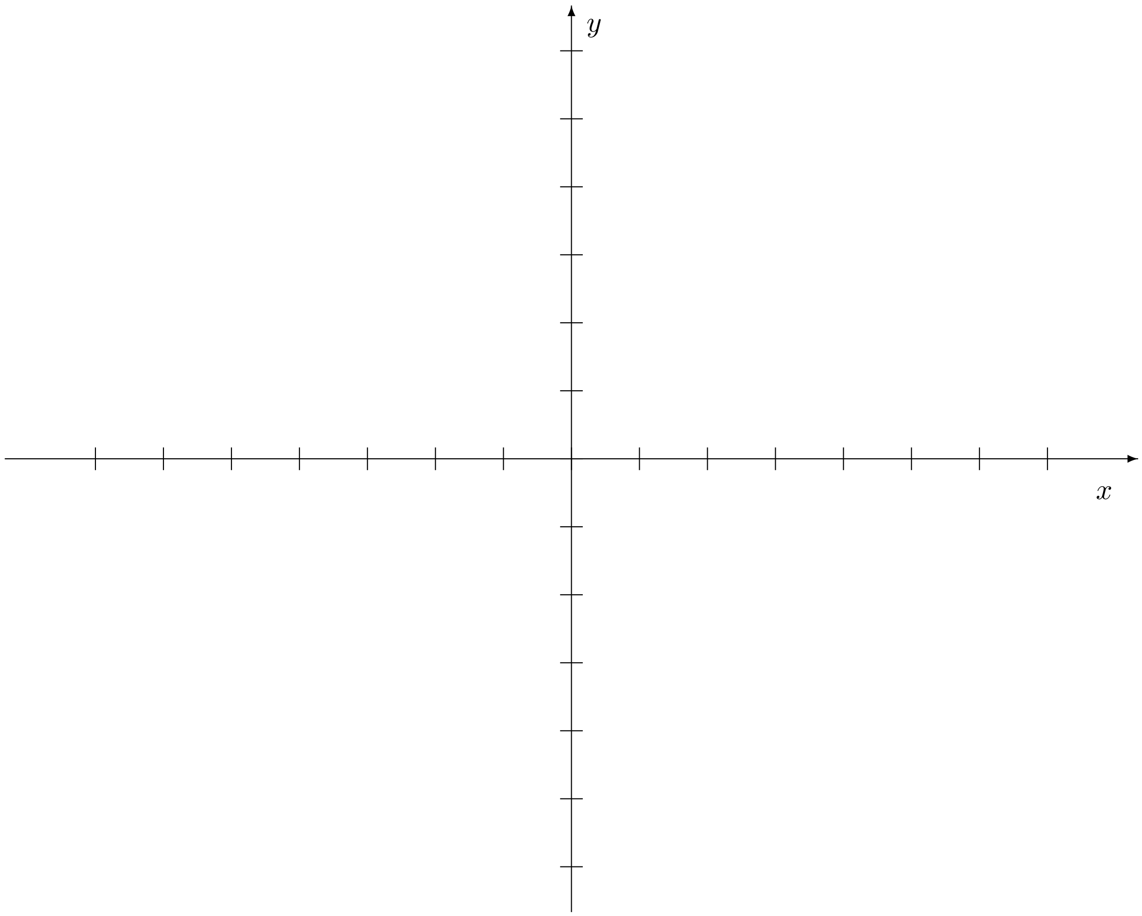
$$(1-x)y' - y = 0, \quad y(0) = 2.$$

9. (A) (6 pts) Write down the Maclaurin series for $f(x) = \cos\sqrt{x}$.

(B) (6 pts) Find a series exression for the definite integral $\int_0^1 \cos\sqrt{x}\, dx$.

10. (12 pts) Find the area of the region in the plane enclosed by the cardioid $r = 2(1 + \cos(\theta))$.

11. (15 pts) Cosider the ellipse $\dfrac{x^2}{25} + \dfrac{y^2}{9} = 1$. Sketch in the following graph the ellipse and indicate the focal points and the lines of Directrix. On the bottom provide your computed results:



(A) Focal Points:

(B) Eccentricity:

(C) Lines of Directrix: