

# Workshop 9

March 22, 2014

Topics: Arc lengths, ODEs, Sequences

## Practice exercises:

### 1. Arc Length

- (a) Calculate the length of  $y = 2(x - 1)^{\frac{3}{2}}$  for  $1 \leq x \leq 5$
- (b) Calculate the length of  $y = \frac{2}{3}(x^2 + 1)^{\frac{3}{2}}$  for  $1 \leq x \leq 4$
- (c) Calculate the length of  $y = \ln(\cos(x))$  for  $0 \leq x \leq \frac{\pi}{4}$
- (d) Calculate the length of  $y = \frac{x^3}{6} + \frac{1}{2x}$  for  $1 \leq x \leq 3$

### 2. Seperable ODEs

- (a)  $\frac{dy}{dx} = x^2y^2 + x^2$
- (b)  $\frac{dy}{dx} = 6y^2x$  with  $y(1) = \frac{1}{25}$
- (c)  $\frac{dy}{dx} = \frac{3x^2+4x-4}{2y-4}$  with  $y(1) = 3$
- (d)  $\frac{dy}{dx} = e^{-y}(2x - 4)$  with  $y(5) = 0$

### 3. Sequences

Determine if the following sequences diverge or converge as  $n \rightarrow \infty$ . If they converge, give the limit (with proof!). If they diverge, prove that they diverge!

By proof I mean make sure you know which theorems you are using, or use an epsilon or two!

- (a)  $a_n = \frac{3n^2-1}{10n+5n^2}$
- (b)  $(-1)^n$
- (c)  $\frac{(-1)^n}{n}$
- (d)  $\frac{n^n}{n!}$
- (e)  $\frac{2^n}{n!}$
- (f)  $\frac{n+47}{\sqrt{n^2+3n}}$
- (g)  $\sqrt{n+47} - \sqrt{n}$