MATH 141 Spring 2016 Final exam practice problems

1. (a) 2
   (b) 3
   (c) e^5
   (d) ∞
   (e) 0
   (f) 0

2. (a) $-\dfrac{\cos^5 x}{5} + \dfrac{2\cos^3 x}{3} - \cos x + C$
   (b) $\arcsin(\dfrac{x+3}{4}) + C$
   (c) $3\ln|x+1| + \ln|x^2+2| + (1/\sqrt{2})\arctan(x/\sqrt{2}) + C$
   (d) $\dfrac{xe^{3x}}{3} - \dfrac{e^{3x}}{9} + C$
   (e) $\dfrac{\sqrt{t^2-16}}{16t} + C$
   (f) $10\ln|x-3| - 9\ln|x-2| + \dfrac{5}{x-2} + C$

3. (a) ∞ – the integral diverges.
   (b) $\pi/8$
   (c) $9/2$
   (d) The integral diverges.

4. $2(1+e^2)\sqrt{1+e^2} - 2(2)\sqrt{2}$

5. $\sqrt{2}\pi$

6. $9\pi/8$

7. $9\pi/2$

8. $(8/23) + (3/22)$; you can split the series into 2 geometric series.

9. $\frac{4}{4+\pi}$ (geometric series)

10. 9/8 (telescoping series)

11. $1 + (1/\sqrt{2})$ (telescoping series)

12. (a) Converges (Root Test)
    (b) Converges (Direct Comparison Test)
    (c) Converges (Alternating Series Test)
    (d) Diverges (nth Term Test)
    (e) Diverges (Ratio Test)

(f) Converges (Limit Comparison Test)

13. (a) $[-1/10, 1/10]$

    (b) $(2, 4]$

14.

$$\int x^3 \cos(x^2)\, dx = C + \frac{x^4}{4} - \frac{x^8}{16} + \frac{x^{12}}{12 \cdot 24} - \frac{x^{16}}{16 \cdot 720} + \cdots = C + \sum_{n=0}^{\infty} (-1)^n \frac{x^{4n+4}}{(4n+4)(2n)!}.$$

15.

$$\int \frac{e^x - 1}{x}\, dx = C + x + \frac{x^2}{4} + \frac{x^3}{18} + \frac{x^4}{96} + \cdots = C + \sum_{n=1}^{\infty} \frac{x^n}{n \cdot n!}.$$