Improper Integrals

$$\int_3^\infty \frac{1}{(x-2)^{\frac{3}{2}}}\,dx = \lim_{a\to\infty} \int_3^a \frac{1}{(x-2)^{\frac{3}{2}}}$$

$y = (x-2)$

$$= \lim_{a\to\infty} \int_3^a y^{-1.5} = \frac{y^{-.5}}{.5} = \frac{-2}{\sqrt{x-2}}$$

$$= -2\cdot\frac{1}{\infty} + 2 = 2$$

Converges.

6. $$\int_0^\infty \frac{1}{4\sqrt{1+x}}\,dx = \lim_{a\to\infty} \int_0^a (4\cdot\sqrt{1+x})^{-1}$$

$$= \lim_{a\to\infty} \frac{1}{4}\cdot\int_0^a (x+1)^{-.5} = 2\cdot(x+1)^{.5}$$

$$= \frac{\sqrt{x+1}}{2}$$

Divergent.

$$\infty - \frac{1}{2} = \infty.$$

7. $$\int_{-\infty}^0 \frac{1}{3-4x}\,dx$$

$$= -\frac{1}{4}\cdot\ln(3-4x)\Big|_{-\infty}^{0}$$

$$0 - \inf = \text{diverges}$$

30. $\int_6^9 \frac{4}{(x-6)^3}\,dx = 4\int_6^9 (x-6)^{-3} = 4^{\text{th}} \cdot \frac{(x-6)^{-2}}{-2}$

Diverges, DNE

8. $\int_1^\infty \frac{1}{(2x+1)^3}\,dx = \lim_{a\to\infty} \int_1^a (2x+1)^{-3} = -\frac{(2x+1)^{-2}}{2}$

Converges $\quad = 0 - \frac{1}{2\cdot(2x+1)^2}$

$\frac{1}{\infty} - \frac{1}{18} = -\frac{1}{18}$

9. $\int_2^\infty e^{-5p}\,dp = -\frac{1}{5}e^{-5p}$

Converges $\quad = \frac{1}{\infty} - \left(\frac{1}{5}\cdot e^{-10}\right)$

$= \frac{1}{5e^{10}}$

10. $\int_{-\infty}^6 2^r\,dr = \frac{2^r}{\ln(2)}$

$= \frac{1}{\ln(2)} - \frac{2^{-\infty}}{\ln(2)}$

$= \frac{1}{\ln(2)} - 0$

$= \frac{1}{\ln(2)}$

27. $\int_0 \frac{3}{x^5} = 3\cdot\int x^{-5}$

$= 3\cdot\frac{x^{-4}}{-4}$

Diverges.

29. $\int_{-2}^{14} \frac{dx}{(x+2)^{.25}} = \int_{-2}^{14} \frac{(x+2)^{.75}}{.75} = \frac{16^{.75}}{.75} - 0$