The exception to the power rule when $n = -1$ is shown below

$$\int \frac{1}{x} \cdot dx = \ln|x| + c$$

Example:

$$\int \frac{1}{2x} \cdot dx = \ln|2x| \cdot \frac{1}{2} + c$$

$$= \frac{1}{2}\ln|2x| + c$$

$$= \underbrace{\frac{1}{2}\ln 2}_{\text{CONSTANT}} + \frac{1}{2}\ln x + c$$

$$= \boxed{\frac{1}{2}\ln x + c}$$

ALT. METHOD

$$\int \frac{1}{2x}\,dx$$

$$\int \frac{1}{2}\cdot\frac{1}{x}\,dx$$

$$\frac{1}{2}\int \frac{1}{x}\,dx$$

$$\boxed{\frac{1}{2}\ln|x| + c}$$

The exception to the power rule when $n = -1$ is shown below

$$\boxed{\int \frac{1}{x} \cdot dx = \ln|x| + c}$$

Example:

$$\int \frac{1}{(2x)} \cdot dx =$$

$$\int \frac{1}{2}\cdot\frac{1}{x}\cdot dx = \frac{1}{2}\int\frac{1}{x}\cdot dx$$

$$= \frac{1}{2}\ln|x| + c$$

$$\frac{1}{2}\ln|2x| + c$$

$$\frac{1}{2}\left(\ln 2 + \ln|x|\right) + c$$

$$\frac{1}{2}\ln 2 + \frac{1}{2}\ln|x| + c$$

$$\frac{1}{2}\ln|x| + c$$

The integral for e works in a similar fashion as the derivative of e.

$$\int e^x \cdot dx = e^x + c$$

Examples:

$$\int e^{3x} \cdot dx = e^{3x} \cdot \frac{1}{3} + c = \boxed{\frac{1}{3}e^{3x} + c}$$

$$\int e^{2-7x} dx = e^{2-7x} \cdot -\frac{1}{7} + c = \boxed{-\frac{1}{7}e^{2-7x} + c}$$

In the beginning, integrals for trig functions will just be the derivative rules in reverse. This will change a bit as we dive deeper into the integration process.

The integrals of trigonometric functions:

$$\int \sin x \, dx = -\cos x + c$$

$$\int \cos x \, dx = \sin x + c$$

$$\int \tan x \, dx = \ln|\sec x| + c$$

EXAM HINT
The integral of $\tan x$ is not given in the Formula booklet and is worth remembering

Examples:

$$\int \cos(3x) dx = \sin(3x) \cdot \frac{1}{3} + c = \boxed{\frac{1}{3}\sin 3x + c}$$

$$\int 4\sin(5x)\cos(5x) dx$$

$$= \int 2 \cdot 2\sin(5x)\cos(5x) \, dx$$

DOUBLE ANGLE IDENTITY

$$\sin(2x) = 2\sin x \cos x$$

$$= \int 2\sin(10x) \, dx$$

$$= 2 \cdot -\cos(10x) \cdot \frac{1}{10} + c$$

$$= -\frac{1}{5}\cos(10x) + c$$