29.

$$M(s) = \sum_x e^{sx} p_X(x)$$
$$= e^s \times \frac{1}{2} + e^{2s} \times \frac{1}{4} + e^{3s} \times \frac{1}{4}$$

所以：

- $E[X] = \frac{d}{ds} M(s)|_{s=0} = \frac{7}{4}$
- $E[X^2] = \frac{d^2}{ds^2} M(s)|_{s=0} = \frac{15}{4}$
- $E[X^3] = \frac{d^3}{ds^3} M(s)|_{s=0} = \frac{37}{4}$

30.

标准正态分布$f_X(x) = \frac{1}{\sqrt{2\pi}} e^{\frac{-x^2}{2}}$，其矩母函数为

$$M(s) = \int_{-\infty}^{\infty} e^{sx} f_X(x) dx$$
$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{\frac{-x^2}{2} + sx} dx$$
$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{x^2 - 2sx + s^2 - s^2}{2}} dx$$
$$= \frac{e^{s^2}}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{(x-s)^2}{2}} dx$$
$$= e^{s^2}$$

所以$E[X^3] = 0, E[X^4] = 12$。

31.

$M(s) = \int_0^{\infty} \lambda e^{-\lambda x + sx} dx = \frac{-\lambda}{s-\lambda}$，所以$E[X^3] = \frac{6}{\lambda^4}, E[X^4] = \frac{24}{\lambda^5}$, $E[X^5] = \frac{120}{\lambda^6}$