Ans.2 $\mu = 5$ hrs

S.d $= 0.5$ hrs

let X be the no of hrs that a laser ~~pointer~~ pointer can work with a pair of AAAA batteries

$\therefore X \sim N(5, 0.5^2)$

let Y be the duration that a laser pointer can work with 20 pairs of AAAA batteries

$Y \sim N(100, 20 * 0.5^2)$

$P(Y \geq 105)$

$= 1 - P(Y < 105)$ #Rcode

$= 1 - \text{pnorm}(105, 100, \sqrt{20} * 0.5)$

$= \boxed{0.01267366}$

Ans.4 X is a D.R.V with PMF

$$P(X=x) \begin{cases} 0.3 & x=-2 \\ 0.6 & x=-1 \\ 0.1 & x=12 \\ 0 & 0.w \end{cases}$$

let $X_1, \ldots X_n$ be IID with same dist^n as X & $\bar{X}$ be sample mean of $(X_1, \ldots X_n)$

a) $E(X) = \sum_x x f(x)$

$= -2 \times 0.3 - 1 \times 0.6 + 12 \times 0.1$

$= -0.6 - 0.6 + 1.2$

$= \boxed{0}$

(b) $Var(X) = E(X^2) - [E(X)]^2$

$= \left[(-2)^2 \times 0.3 + (-1)^2 \times 0.6 + (12)^2 \times 0.1\right] - 0^2$

$= 1.2 + 0.6 + 14.4 - 0$

$= \boxed{16.2}$

(c) $E(\bar{X}) = \mu = \boxed{0}$

(d) $Variance(\bar{X}) = \frac{\sigma^2}{n} = \frac{16.2}{n}$

(e) For $n = 100$ $\quad \bar{X} \sim N\left(0, \frac{16.2}{100}\right)$

$P(\bar{X} > 0.5)$

$1 - P(\bar{X} \leq 0.5)$ $\quad Sd = \frac{\sqrt{16.2}}{10} = 0.40249$

#rcode

1- pnorm(0.5, 0, 0.40249)

$= \boxed{0.0107073}$

Ans 3 (a) Fluctuations of Value Stock are $X_1, X_2 \dots X_{400}$

" " Growth " " $Y_1, Y_2 \dots Y_{400}$

$E[X_i] = 0.01$; $Var[X_i] = 0.01$; $E[Y_i] = 0$ $Var[Y_i] = 0.25$

Let combined fluctuation be for Value stock $\rightarrow X = X_1 + X_2 + \dots + X_{400}$

" " " " Growth stock $\rightarrow Y = Y_1 + Y_2 + \dots + Y_{400}$

$E[X] = 400 \times 0.01 = 4$ $Var[X] = 400 \times 0.01 = 4$

$E[Y] = 400 \times 0 = 0$ $Var[Y] = 400 \times 0.25 = 100$

(a) $P(X > 0) = 1 - P(X \leq 0)$

Rcode

$= 1 - pnorm(0, 4, 2)$

$= \boxed{0.09772499}$

(b) $P(Y > 0) = 1 - P(Y \leq 0)$

Rcode

$= 1 - pnorm(0, 0, 10)$

$= \boxed{0.5}$

(c) $P(X \geq 20) = 1 - P(X \leq 20)$

$= 1 - pnorm(20, 4, 2)$

$= 6.661338e^{-16}$

$\simeq 0$

(d) $P(Y \geq 20)$

$= 1 - P(Y \leq 20)$

r code

$= 1 - pnorm(20, 0, 10)$

$= \boxed{0.02275013}$

(e) $P(Y > X)$

$P(Y - X > 0)$

$= 1 - P(Y - X \leq 0)$

For $Y - X$

$E(Y - X) = 0 - 4 = -4$

$Var(Y - X) = 100 + (-1)^2 \times 4$

$Var(Y - X) = 104$

$= 1 - pnorm(0, -4, \sqrt{104})$

$= \boxed{0.34744433}$