Problem 1 Scratch Work

$\text{In[•]:= } \mathbf{z = Sum}\left[\dfrac{1}{n^2}, \{n, \text{Infinity}\}\right]$

$\mathbf{pNot1 = 1 - \dfrac{6}{\pi^2}} \text{ // N}$

$\mathbf{EbarSum = Sum}\left[\dfrac{\text{Log[n]}}{n^2}, \{n, \text{Infinity}\}\right] \text{ // N}$

$\mathbf{Ebar = \dfrac{12\, k\, T\, EbarSum}{\pi^2}}$

$\text{Out[•]= } \dfrac{\pi^2}{6}$

$\text{Out[•]= } 0.392073$

$\text{Out[•]= } 0.937548$

$\text{Out[•]= } 1.13992\, k\, T$

Problem 3

```
In[•]:= e = 1.602*^-19;
    u0 = 5*^6 e;
    k = 1.381*^-23;
    r0 = 4*^-10;
```

$$B[T\_] = -2\,\pi\, \text{Integrate}\left[r^2\left(e^{\frac{-\left(u0 - \frac{u0}{r0}\,r\right)}{k\,T}} - 1\right), \{r, 0, r0\}\right];$$

```
    Plot[B[T]/r0³, {T, 100, 1000}]
    B[200] 6.022*^23 × 1000
    B[200] 6.022*^23 × 1000 / (8.315 × 200 × 1000 + 1.34*^-28 × 6.022*^23 × 1000)
```
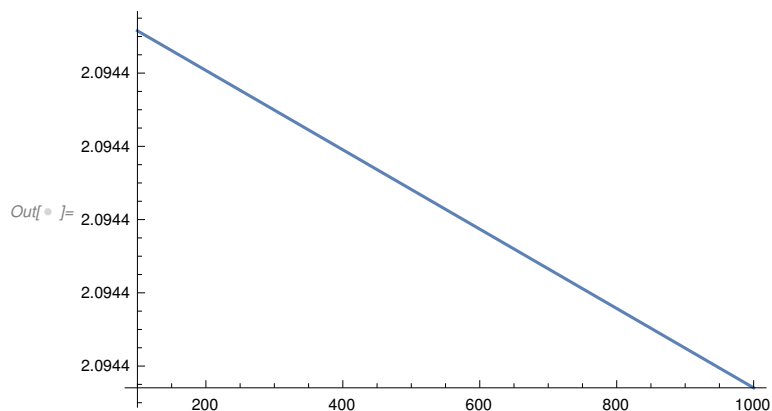


```
Out[•]= 0.0807197
```

$$\text{Out[•]= } 4.85386 \times 10^{-8}$$

Problem 6

```
In[•]:= μ0 = .35;
    α = .0015;
    T0 = 240;
    ef = μ0 + α (T - T0);
    k = 8.617*^-5;
```

$$\text{rhs} = \text{Integrate}\left[\frac{\pi^2\, k^2\, T}{2\,\text{ef}\,(\mu0 + \alpha\, T - T0)}, T\right];$$

$$\text{Re}\left[e^{\text{rhs}/.T\to295-\text{rhs}/.T\to0}\right] \text{(* Imaginary numbers are small enough *)}$$

```
Out[•]= 1.21543
```

In[ ]:= **D[A Log[b u], u]**

Out[ ]= $\dfrac{A}{u}$

In[ ]:= **15*^3 / 45 // N**

Out[ ]= 333.333