Контрольная работа

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```python
import numpy_financial as npf
import sympy as sp

import bond
import intrest
```

In [229...

Задача 1

In [230...

```python
start_a = 1000
end_a = 1110
i_a = sp.Symbol('i')
t_a = sp.Symbol('t')

start_b = 500
i_b = 3 * i_a
t_b = 2 * t_a
```

Формула простых процентов:

In [231...

```python
intrest.simple_interest(*sp.symbols('S S_0 i t'))
```

Out[231...

$$S = S_0 \left(it + 1 \right)$$

In [232...

```python
f1 = intrest.simple_interest(end_a, start_a, i_a, t_a)
f1
```

Out[232...

$$1110 = 1000it + 1000$$

In [233...

```python
it = sp.solve(f1, [i_a * t_a])[0]
it
```

Out[233...

$$\frac{11}{100}$$

In [234...

```python
f2 = intrest.simple_interest(sp.Symbol('S'), start_b, i_b, t_b)
f2
```

Out[234...

$$S = 3000it + 500$$

In [235...

```python
end_b = f2.subs(i_a * t_a, it)
end_b
```

Out[235...

$$S = 830$$

```
end_b_value = sp.solve(end_b)[0]
end_b_value
```

Out[236... 830

Ответ: 830

Задача 2

```
i = 0.155
s_0 = 1_000_000
t = 5
```

Формула сложных процентов:

```
intrest.compound_interest(*sp.symbols('S S_0 i t'))
```

Out[238... $S = S_0(i + 1)^t$

```
s = intrest.compound_interest(sp.Symbol('S'), s_0, i, t)
s
```

Out[239... $S = 2055464.21922188$

```
s_value = sp.solve(s)[0]
s_value
```

Out[240... 2055464.21922188

Ответ: 2055464.22

Задача 3

Идея решения задачи:

$$NPV = \sum_k S_{t_k}(1 + i)^{-t_k}$$

```
f_a = [-1000, 300, 200, 100, 100, 800]
f_b = [-1000, 800, 100, 100, 200, 300]
i = 0.1
```

```
npv_a = npf.npv(i, f_a)
npv_a
```

Out[242... 78.18641299960859

```
npv_b = npf.npv(i, f_b)
npv_b
```

Out[243... 207.92792345281913

Ответ: инвестиционный проект B лучше (207.93 > 78.19)

Задача 4

Идея решения задачи:

$$\frac{\Delta P}{P} = -D^* \Delta \gamma$$
$$D^* = \frac{D}{1+\gamma}$$

In [244...
```python
p_1 = 2000
y_1 = 0.06
y_2 = 0.07
duration = 8
```

In [245...
```python
m_duration = duration / (1 + y_1)
m_duration
```

Out[245... 7.547169811320754

In [246...
```python
delta_p = sp.Eq(sp.Symbol('\Delta P') / sp.Symbol('P'), -m_duration * (y_2 - y_1)).subs(sp
delta_p
```

Out[246... $\frac{\Delta P}{2000} = -0.0754716981132076$

In [247...
```python
delta_p_value = sp.solve(delta_p)[0]
delta_p_value
```

Out[247... -150.943396226415

In [248...
```python
p2 = p_1 + delta_p_value
p2
```

Out[248... 1849.05660377358

Ответ: 1849.057

Задача 5

Идея решения задачи:

$$NPV = \frac{C}{i}\left(1 - \frac{1}{(1+i)^t}\right) + \frac{F}{(1+i)^t}$$

In [249...
```python
f = 1000
t = 10
c = 0.1
i = 0.08
```

In [250...
```python
npv = bond.npv(sp.Symbol('NPV'), f, c * f, i, t)
npv
```

Out[250... $NPV = 1134.20162797883$

In [251...

```
npv_value = sp.solve(npv)[0]
npv_value
```

Out[251... 1134.20162797883

Ответ: 1134.202