ФГБОУ ВО "Воронежский государственный
технический университет"

Кафедра высшей математики и
физико-математического моделирования

**ИНДИВИДУАЛЬНЫЕ ДОМАШНИЕ ЗАДАНИЯ
К РАЗДЕЛУ
«ЭЛЕМЕНТЫ ОПЕРАЦИОННОГО ИСЧИСЛЕНИЯ»**

МЕТОДИЧЕСКИЕ УКАЗАНИЯ

для индивидуальной самостоятельной работы по разделу
«Элементы операционного исчисления»
курса «Спецглавы математики» для студентов для студентов
направления 11.03.01 «Радиотехника»

Воронеж 2020

ИНДИВИДУАЛЬНЫЕ РАСЧЕТНЫЕ ЗАДАНИЯ
К РАЗДЕЛУ «ОПЕРАЦИОННОЕ ИСЧИСЛЕНИЕ И ЕГО ПРИЛОЖЕНИЯ»

Задача 1. Найдите изображение данного оригинала.

1.1.

$$f(t) = e^{3t} \cos 2t + \operatorname{sh} \frac{t}{4} + t^2 e^{3t}.$$

1.2.

$$f(t) = e^{t} \cos \frac{t}{2} + t^3 e^{-5t} - \operatorname{sh} 3t.$$

1.3.

$$f(t) = t^2 e^{-4t} + e^{5t} \cos 2t + \operatorname{ch} \frac{t}{3}.$$

1.4.

$$f(t) = e^{-6t} \sin \frac{t}{7} - t^2 e^{7t} + \operatorname{ch} 2t.$$

1.5.

$$f(t) = -2t \sin 3t + t^5 e^{2t} + \operatorname{ch} 4t.$$

1.6.

$$f(t) = e^{-2t} \sin 5t + t^9 e^{-2t} - \operatorname{sh} 3t.$$

1.7.

$$f(t) = 3t \sin \frac{t}{4} - t^2 e^{t/2} + \operatorname{ch} 2t.$$

1.8.

$$f(t) = e^{-3t} \cos 3t - 2t^3 e^{-t} + \operatorname{ch} \frac{t}{2}.$$

1.9.

$$f(t) = te^{-3t} + e^{-t} \cos \frac{t}{2} - \operatorname{sh} 4t.$$

1.10.

$$f(t) = \operatorname{ch} \frac{t}{4} + e^{8t} \cos 3t + t^4 e^{5t}.$$

1.11.

$$f(t) = -\frac{t}{2} \sin 3t - t^3 e^{-t} + \operatorname{sh} \frac{t}{3}.$$

1.12.

$$f(t) = \frac{t}{4} \cos 3t + t^3 e^{-t/2} + \operatorname{ch} \frac{2}{3} t.$$

1.13.

$$f(t) = t^4 e^{-t} + e^{-5t} \sin 2t + \operatorname{ch} \frac{t}{2}.$$

1.14.

1.15.
$$f(t) = e^{t/2}\sin t + t^4 e^{-3t} + \operatorname{ch} 5t.$$

1.16.
$$f(t) = t\sin 3t + t^2 e^{-5t} - 2\operatorname{ch} 2t.$$

1.17.
$$f(t) = e^{5t}\sin 2t + t^3 e^{-t/2} + \operatorname{sh} 3t.$$

1.18.
$$f(t) = 5t\sin 3t + t^2 e^{-t} + \operatorname{ch} 3t.$$

1.19.
$$f(t) = e^{t/2}\sin 2t + t^3 e^{-t} - \operatorname{sh} 4t.$$

1.20.
$$f(t) = e^{-2t}\cos 4t + t^3 e^{t/2} - 4\operatorname{ch} t.$$

1.21.
$$f(t) = e^{t/3}\sin t - t^3 e^{-7t} + \operatorname{ch}\frac{3}{2}t.$$

1.22.
$$f(t) = e^{-t}\cos\frac{t}{2} - 2t^3 e^{-t} - \frac{\operatorname{sh} 3t}{4}.$$

1.23.
$$f(t) = -t\cos t + t^2 e^{-5t} - 4\operatorname{sh} 3t.$$

1.24.
$$f(t) = 4\operatorname{ch} 3t + t^4 e^{-t/3} - t\sin 2t.$$

1.25.
$$f(t) = e^{-t/2}\sin 5t + t^3 e^{5t} - \frac{\operatorname{sh} 3t}{3}.$$

1.26.
$$f(t) = -\frac{t}{2}\sin 3t + t^5 e^{2t} - 3\operatorname{ch} t.$$

1.27.
$$f(t) = t^2 e^{-t/3} - e^{4t}\sin\frac{t}{3} + \operatorname{sh} 3t.$$

1.28.
$$f(t) = -6t\sin 2t - t^2 e^{-2t} + \operatorname{ch}\frac{t}{2}.$$

1.29.
$$f(t) = 2t\cos\frac{t}{3} + \operatorname{sh} 5t + t^3 e^{-3t}.$$

1.30.
$$f(t) = e^{-3t}\sin 2t + t^4 e^{t/2} + \operatorname{ch}\frac{t}{3}.$$

Задача 2. Найдите изображение данного оригинала.

2.1.
$$f(t) = \cos 3t\sin 4t.$$

2.2.
$$f(t) = \operatorname{sh} 3t\operatorname{ch} 2t.$$

2.3.

$$f(t) = \operatorname{ch} 2t \operatorname{ch} 3t.$$

2.4.

$$f(t) = \sin 2t \cos 4t.$$

2.5.

$$f(t) = \sin 3t \sin 5t.$$

2.6.

$$f(t) = \operatorname{sh} 5t \operatorname{ch} 3t.$$

2.7.

$$f(t) = \operatorname{sh} 3t \operatorname{ch} t.$$

2.8.

$$f(t) = \cos 3t \cos 9t.$$

2.9.

$$f(t) = \sin 9t \cos 5t.$$

2.10.

$$f(t) = \operatorname{sh} 10t \operatorname{sh} 3t.$$

2.11.

$$f(t) = \cos 7t \cos 2t.$$

2.12.

$$f(t) = \sin 7t \cos 3t.$$

1.13.

$$f(t) = \operatorname{sh} 6t \operatorname{ch} 10t.$$

1.14.

$$f(t) = \operatorname{sh} 7t \operatorname{sh} 3t.$$

2.15.

$$f(t) = \sin 7t \cos 7t.$$

2.16.

$$f(t) = \cos^2 4t.$$

2.17.

$$f(t) = \operatorname{sh} 3t \operatorname{ch} 3t.$$

2.18.

$$f(t) = \cos 5t \sin 3t.$$

2.19.

$$f(t) = \sin 3t \sin 9t.$$

2.20.

$$f(t) = \operatorname{ch} 4t \operatorname{sh} 4t.$$

2.21.

$$f(t) = \cos 3t \sin 3t.$$

2.22.

$$f(t) = \operatorname{ch} t \operatorname{ch} 5t.$$

2.23.

$$f(t) = \cos 2t \cos 3t.$$

2.24.

$$f(t) = \cos 2t \sin 8t.$$

2.25.

$$f(t) = \operatorname{ch} 8t \operatorname{sh} 9t.$$

2.26.

$$f(t) = \sin^2 3t.$$

2.27.

$$f(t) = \operatorname{ch} 3t \operatorname{sh} 9t.$$

2.28.

$$f(t) = \operatorname{ch} 2t \operatorname{ch} 4t.$$

2.29.

$$f(t) = \sin 3t \sin 2t.$$

2.30.

$$f(t) = \operatorname{ch} 4t \operatorname{ch} 3t.$$

Задача 3. Найдите изображение данного оригинала.

3.1.

$$f(t) = \int_0^t \tau^2 \left(e^{3\tau} - e^{2\tau} \right) d\tau.$$

3.2.

$$f(t) = \int_0^t \left(2 + \operatorname{ch}^2 \tau \right) d\tau.$$

3.3.

$$f(t) = \int_0^t \tau \cos^2 \tau d\tau.$$

3.4.

$$f(t) = \int_0^t \tau \sin^2 3\tau d\tau.$$

3.5.

$$f(t) = \int_0^t \tau^4 \left(1 + e^{2\tau} \right) d\tau.$$

3.6.

$$f(t) = \int_0^t \tau^2 e^{-5\tau} d\tau.$$

3.7.

$$f(t) = \int_0^t \operatorname{sh}^2 \tau d\tau.$$

3.8.

$$f(t) = \int_0^t \tau \sin^2 4\tau d\tau.$$

3.9.

$$f(t) = \int_0^t \tau \sin^2 4\tau d\tau.$$

3.10.

$$f(t) = \int_0^t \tau \cos^2 3\tau d\tau.$$

3.11.

$$f(t) = \int_0^t \tau^2 e^{-4\tau} d\tau.$$

3.12.

$$f(t) = \int_0^t \left(\tau + \mathrm{ch}^2 5\tau\right) d\tau.$$

3.13.

$$f(t) = \int_0^t \tau \cos^2 4\tau d\tau.$$

3.14.

$$f(t) = \int_0^t \tau^4 e^{-\tau/2} d\tau.$$

3.15.

$$f(t) = \int_0^t \left(\tau + e^{2t}\right) \sin 3\tau d\tau.$$

3.16

$$f(t) = \int_0^t \left(\tau^2 + \mathrm{sh}^2 2\tau\right) d\tau.$$

3.17.

$$f(t) = \int_0^t \tau^2 \left(e^{2\tau} + e^{-3\tau}\right) d\tau.$$

3.18.

$$f(t) = \int_0^t \tau^3 \left(e^{-2\tau} - e^{-4\tau}\right) d\tau.$$

3.19.

$$f(t) = \int_0^t \tau \sin^2 6\tau d\tau.$$

3.20.

$$f(t) = \int_0^t \left(\tau^2 + \mathrm{sh}^2 2\tau\right) d\tau.$$

3.21.

$$f(t) = \int_0^t \left(\tau^3 - \mathrm{sh}^2 3\tau\right) d\tau.$$

3.22.

$$f(t) = \int_0^t \left(\tau + e^{3t}\right) \cos 2\tau d\tau.$$

3.23.

$$f(t) = \int_0^t \left(\tau^4 - \text{ch}^2 2\tau \right) d\tau.$$

3.24.

$$f(t) = \int_0^t \tau^2 \left(e^{3\tau} - e^{2\tau} \right) d\tau.$$

3.25.

$$f(t) = \int_0^t \tau^3 \left(e^{5\tau} - 3 \right) d\tau.$$

3.26.

$$f(t) = \int_0^t \left(\tau^2 - \text{ch}^2 3\tau \right) d\tau.$$

3.27.

$$f(t) = \int_0^t \tau \sin^2 2\tau \, d\tau.$$

3.28.

$$f(t) = \int_0^t \tau^3 \left(e^{-2\tau} - e^{-4\tau} \right) d\tau.$$

3.29.

$$f(t) = \int_0^t \left(\text{sh}^2 3\tau - 1 \right) d\tau.$$

3.30.

$$f(t) = \int_0^t \left(\tau + \text{ch}^2 2\tau \right) d\tau.$$

Задача 4. Найдите изображение данного оригинала.

4.1.

$$f(t) = \text{sh}^2 (t-3) \cdot \eta(t-3).$$

4.2.

$$f(t) = \sin^2 (t-2) \cdot \eta(t-2).$$

4.3.

$$f(t) = \text{ch}^2 (t-4) \cdot \eta(t-4).$$

4.4.

$$f(t) = \sin (t-2\pi) \cdot \eta(t-2\pi).$$

4.5.

$$f(t) = (t-2)^3 \cdot \eta(t-2).$$

4.6.

$$f(t) = \cos^2 (t-7) \cdot \eta(t-7).$$

4.7.

4.8.

$f(t) = \cos^2(t-\pi) \cdot \eta(t-\pi).$

$f(t) = e^{(t-3)} \sin(2t-6) \cdot \eta(t-3).$

4.9.

4.10.

$f(t) = (3t-9)^3 \cdot \eta(t-3).$

$f(t) = (t-1)\cos(t-1) \cdot \eta(t-1).$

4.11.

4.12.

$f(t) = \sin^2(t-\pi) \cdot \eta(t-\pi).$

$f(t) = \operatorname{ch}^2(t-3) \cdot \eta(t-3).$

4.13.

4.14.

$f(t) = \operatorname{ch}(t-9) \cdot \eta(t-9).$

$f(t) = \cos^2(t-2\pi) \cdot \eta(t-2\pi).$

4.15.

4.16.

$f(t) = (5t-2)^4 \cdot \eta\left(t - \dfrac{2}{5}\right).$

$f(t) = e^{3(t-3)} \sin(t-3) \cdot \eta(t-3).$

4.17.

4.18.

$f(t) = (3t-9)^2 e^{t-3} \cdot \eta(t-3).$

$f(t) = (2t-2)^4 \cdot \eta(t-1).$

4.19.

4.20.

$f(t) = (t-4)^3 e^{2t-8} \cdot \eta(t-4).$

$f(t) = (t-6)^3 e^{t-6} \cdot \eta(t-6).$

4.21.

4.22.

$f(t) = (2t-1)^3 \cdot \eta\left(t - \dfrac{1}{2}\right).$

$f(t) = e^{3t-1} \cdot \eta\left(t - \dfrac{1}{3}\right).$

4.23.

4.24.

$f(t) = (t-9)^2 \sqrt{e^{t-9}} \cdot \eta(t-9).$

$f(t) = (t-1)^4 e^{2t-2} \cdot \eta(t-1).$

4.25.

4.26.

$$f(t) = \operatorname{sh}(2t - \pi) \cdot \eta\left(t - \frac{\pi}{2}\right). \qquad f(t) = \cos(3t - 2\pi) \cdot \eta\left(t - \frac{2}{3}\pi\right).$$

4.27.

$$f(t) = (2t - 6)^3 e^{t-3} \cdot \eta(t - 3). \qquad f(t) = \cos(3t - 9) \cdot \eta(t - 3).$$

4.29.

4.30.

$$f(t) = (2t - 4)^2 \cdot \eta(t - 2). \qquad f(t) = (t - 7)^3 e^{2(t-7)} \cdot \eta(t - 7).$$

Задача 5. Найдите изображение данного оригинала.

5.1.

5.2.

$$f(t) = \int_0^t (t - \tau)^4 \operatorname{sh} 2\tau \, d\tau. \qquad f(t) = \int_0^t \tau^3 e^{t-\tau} d\tau.$$

5.3.

5.4.

$$f(t) = \int_0^t (t - \tau)^3 \operatorname{ch} 5\tau \, d\tau. \qquad f(t) = \int_0^t (t - \tau)^2 \cos 3\tau \, d\tau.$$

5.5.

5.6.

$$f(t) = \int_0^t (t - \tau)^2 e^{3\tau} d\tau. \qquad f(t) = \int_0^t (t - \tau)^2 \sin 2\tau \, d\tau.$$

5.7.

5.8.

$$f(t) = \int_0^t (t - \tau)^2 \operatorname{sh} 7\tau \, d\tau. \qquad f(t) = \int_0^t \tau^3 \cos 2(t - \tau) \, d\tau.$$

5.9.

5.10.

$$f(t) = \int_0^t (t - \tau)^2 \sin 5\tau \, d\tau. \qquad f(t) = \int_0^t (t - \tau)^2 \sin 5\tau \, d\tau.$$

5.11.
$$f(t) = \int\limits_0^t \tau^3 e^{5(t-\tau)} d\tau.$$

5.12.
$$f(t) = \int\limits_0^t (t-\tau)^2 \sin 2\tau d\tau.$$

5.13.
$$f(t) = \int\limits_0^t \tau^2 e^{t-\tau} d\tau.$$

5.14.
$$f(t) = \int\limits_0^t (t-\tau)^2 \operatorname{sh} 7\tau d\tau.$$

5.15.
$$f(t) = \int\limits_0^t \tau^2 \sin(t-\tau) d\tau.$$

5.16.
$$f(t) = \int\limits_0^t (t-\tau)^4 e^{7\tau} d\tau.$$

5.17.
$$f(t) = \int\limits_0^t (t-\tau)^3 \sin 4\tau d\tau.$$

5.18.
$$f(t) = \int\limits_0^t (t-\tau)^3 \operatorname{ch} 9\tau d\tau.$$

5.19.
$$f(t) = \int\limits_0^t (t-\tau)^2 \cos 3\tau d\tau.$$

5.20.
$$f(t) = \int\limits_0^t \tau^2 e^{2(t-\tau)} d\tau.$$

5.21.
$$f(t) = \int\limits_0^t \tau^3 \cos 2(t-\tau) d\tau.$$

5.22.
$$f(t) = \int\limits_0^t (t-\tau)^4 \operatorname{sh} 2\tau d\tau.$$

5.23.
$$f(t) = \int\limits_0^t (t-\tau)^4 e^{2\tau} d\tau.$$

5.24.
$$f(t) = \int\limits_0^t (t-\tau)^3 \operatorname{ch} 5\tau d\tau.$$

5.25.
$$f(t) = \int\limits_0^t (t-\tau)^2 \sin 5\tau d\tau.$$

5.26.
$$f(t) = \int\limits_0^t (t-\tau)^3 \operatorname{sh} 9\tau d\tau.$$

5.27.

$$f(t) = \int_0^t \tau^3 e^{5(t-\tau)} d\tau.$$

5.28.

$$f(t) = \int_0^t (t-\tau)^2 e^{3\tau} d\tau.$$

5.29.

$$f(t) = \int_0^t \cos(t-\tau)\sin\tau d\tau.$$

5.30.

$$f(t) = \int_0^t (t-\tau)^2 \sin 2\tau d\tau.$$

Задача 6. Найдите изображение данного оригинала.

6.1.

$$f(t) = \frac{1-\cos 3t}{t}.$$

6.2.

$$f(t) = \frac{\sin 2t}{t}.$$

6.3.

$$f(t) = \frac{\sin 4t - \sin 2t}{t}.$$

6.4.

$$f(t) = \frac{e^{3t} - e^t}{t}.$$

6.5.

$$f(t) = \frac{\cos 5t - e^{-3t}\cos t}{t}.$$

6.6.

$$f(t) = \frac{\cos^2 3t}{t}.$$

6.7.

$$f(t) = \frac{\cos t + \cos 3t}{t}.$$

6.8.

$$f(t) = \frac{\sin 3t + \sin 2t}{t}.$$

6.9.

$$f(t) = \frac{\cos 6t - \cos 3t}{t}.$$

6.10.

$$f(t) = \frac{\cos 4t - \operatorname{ch} 3t}{t}.$$

6.11.

$$f(t) = \frac{\cos 4t}{t}.$$

6.12.

$$f(t) = \frac{\cos 4t - \operatorname{ch} 3t}{t}.$$

6.13.

$$f(t) = \frac{e^{5t} - 1}{t}.$$

6.14.

$$f(t) = \frac{\cos^2 3t}{t}.$$

6.15.

$$f(t) = \frac{\sin 7t - \sin 4t}{t}.$$

6.16.

$$f(t) = \frac{e^{7t} - e^{2t}}{t}.$$

6.17.

$$f(t) = \frac{e^{2t} - 1}{t}.$$

6.18.

$$f(t) = \frac{\cos 6t - \cos 3t}{t}.$$

6.19.

$$f(t) = \frac{\sin 3t + \sin 2t}{t}.$$

6.20.

$$f(t) = \frac{\cos 5t - e^{-3t} \cos t}{t}.$$

6.21.

$$f(t) = \frac{\cos 3t - te^{2t}}{t}.$$

6.22.

$$f(t) = \frac{\cos 6t - \cos 3t}{t}.$$

6.23.

$$f(t) = \frac{e^t - e^{3t}}{t}.$$

6.24.

$$f(t) = \frac{\sin 2t}{t}.$$

6.25.

$$f(t) = \frac{\sin^2 3t}{t}.$$

6.26.

$$f(t) = \frac{\sin 3t + \sin 2t}{t}.$$

6.27.

$$f(t) = \frac{\cos 4t}{t}.$$

6.28.

$$f(t) = \frac{1 - \cos 5t}{t}.$$

6.29.

$$f(t) = \frac{e^{3t} - 1}{t}.$$

6.30.

$$f(t) = \frac{\cos 5t - e^{-3t} \cos t}{t}.$$

Задача 7. Найдите изображение данного оригинала.

7.1.
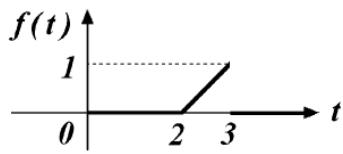
7.2.
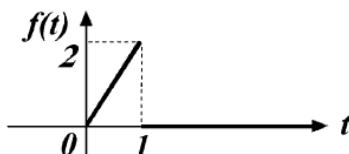
7.3.

7.4.
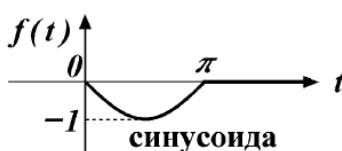
7.5.
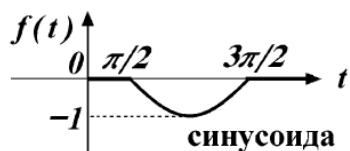
7.6.
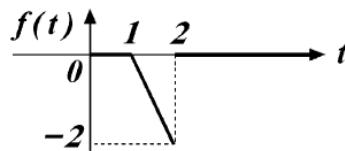
7.7.

7.8.
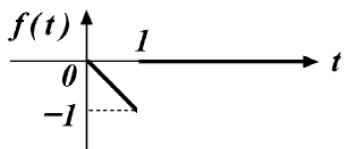
7.9.
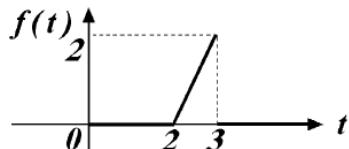
7.10.
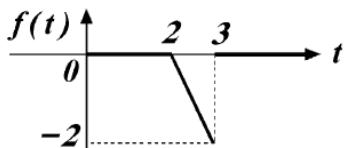
7.11.

7.12.



7.13.

7.14.

7.15.

7.16.

14

7.17.

7.18.

7.19.

7.20.

7.21.

7.22.

7.23.

7.24.

7.25.

7.26.

15

7.27.

7.28.

7.29.
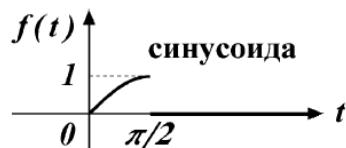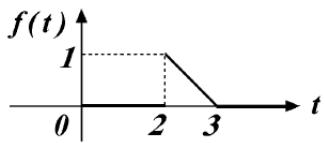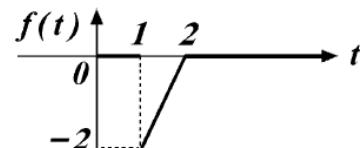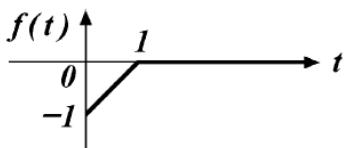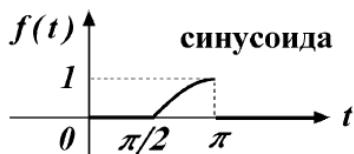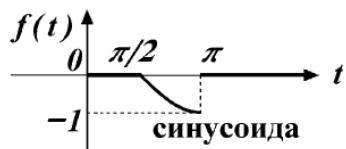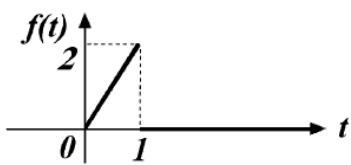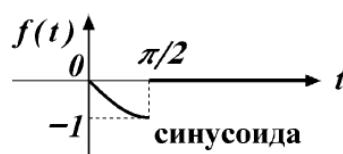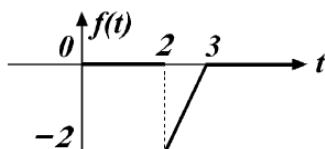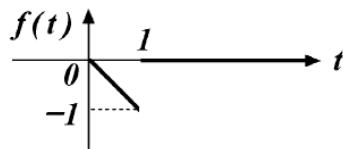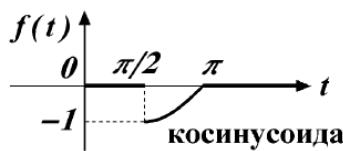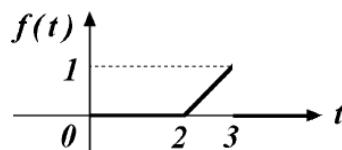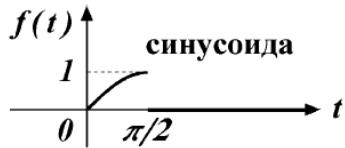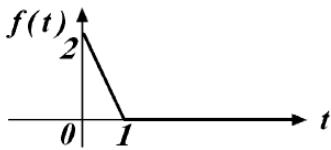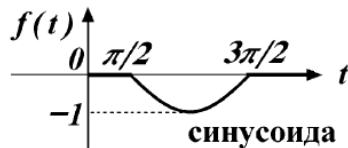
7.30.

Задача 8. Найти оригинал по заданному изображению с помощью свойств преобразования Лапласа.

8.1.

$$F(p) = \frac{2e^{-3p}}{(p-4)^2}.$$

8.2.

$$F(p) = \frac{d}{dp}\left[\frac{2(p-1)}{(p-1)^2 + 16}\right].$$

8.3.

$$F(p) = \frac{4e^{-p}}{(p-3)^4}.$$

8.4.

$$F(p) = \frac{3e^{-2p}}{(p-1)^3}.$$

8.5.

$$F(p) = \frac{d}{dp}\left[\frac{3(p+1)}{(p+1)^2 + 9}\right].$$

8.6.

$$F(p) = \frac{d}{dp}\left[\frac{5}{(p+3)^2 + 1}\right].$$

8.7.

$$F(p) = \frac{d}{dp}\left[\frac{2(p-1)}{(p-1)^2 - 16}\right].$$

8.8.

$$F(p) = \frac{d}{dp}\left[\frac{9}{(p+1)^2 + 9}\right].$$

8.9.

$$F(p) = \frac{2e^{-3(p-4)}}{(p-4)^2}.$$

8.10.

$$F(p) = \frac{4e^{-(p-3)}}{(p-3)^4}.$$

8.11.

$$F(p) = \frac{d}{dp}\left[\frac{8}{(p-3)^2 + 4}\right].$$

8.12.

$$F(p) = \frac{d}{dp}\left[\frac{8(p-1)}{(p-1)^2 + 16}\right].$$

8.13.

$$F(p) = \frac{3e^{-2p}}{(p-1)^3}.$$

8.14.

$$F(p) = \frac{d}{dp}\left[\frac{3(p+1)}{(p+1)^2 + 9}\right].$$

8.15.

$$F(p) = \frac{d}{dp}\left[\frac{3(p+1)}{(p+1)^2 - 9}\right].$$

8.16.

$$F(p) = \frac{4e^{-p}}{(p-3)^4}.$$

8.17.

$$F(p) = \frac{d}{dp}\left[\frac{2(p-1)}{(p-1)^2 + 16}\right].$$

8.18.

$$F(p) = \frac{d}{dp}\left[\frac{5(p+3)}{(p+3)^2 + 1}\right].$$

8.19.

$$F(p) = \frac{3e^{-2(p-1)}}{(p-1)^3}.$$

8.20.

$$F(p) = \frac{d}{dp}\left[\frac{9}{(p+1)^2 + 9}\right].$$

8.21.

$$F(p) = \frac{d}{dp}\left[\frac{5}{(p+3)^2 + 1}\right].$$

8.22.

$$F(p) = \frac{4e^{-p}}{(p-3)^4}.$$

8.23.

$$F(p) = \frac{d}{dp}\left[\frac{3(p+1)}{(p+1)^2 + 9}\right].$$

8.24.

$$F(p) = \frac{4e^{-3p}}{(p-2)^3}.$$

8.25.

$$F(p) = \frac{2e^{-3p}}{(p-4)^2}.$$

8.26.

$$F(p) = \frac{d}{dp}\left[\frac{9}{(p+1)^2 + 9}\right].$$

8.27.

$$F(p) = \frac{3e^{-2(p-1)}}{(p-1)^3}.$$

8.28.

$$F(p) = \frac{d}{dp}\left[\frac{4(p-3)}{(p-3)^2 + 4}\right].$$

8.29.

$$F(p) = \frac{3e^{-(p-2)}}{(p-1)^4}.$$

8.30.

$$F(p) = \frac{2e^{-3(p-4)}}{(p-4)^2}.$$

Задача 9. Найти оригинал по заданному изображению с помощью разложения рациональной дроби на простейшие.

9.1.

$$F(p) = \frac{p^2 + 2}{(p+1)(p+2)^2}.$$

9.2.

$$F(p) = \frac{-3}{p^2(p+1)^2}.$$

9.3.

$$F(p) = \frac{-6p^2 - 1}{(p+4)(p-2)^2}.$$

9.4.

$$F(p) = \frac{2p^2}{(p+2)^2(p-3)}.$$

9.5.

$$F(p) = \frac{5p}{(p+2)(p-2)^2}.$$

9.6.

$$F(p) = \frac{7p^2 + 1}{(p+1)(p-3)^2}.$$

9.7.

$$F(p) = \frac{2p+1}{(p-1)(p+1)^2}.$$

9.8.

$$F(p) = \frac{3p^2 + 2}{(p-4)(p+5)^2}.$$

9.9.

$$F(p) = \frac{-2p^2 + 3p - 8}{p(p-3)^2}.$$

9.10.

$$F(p) = \frac{p^2 + 3p - 7}{(p+7)(p-6)^2}.$$

9.11.

$$F(p) = \frac{4p^2 + p - 6}{(p+1)(p-3)^2}.$$

9.12.

$$F(p) = \frac{3p^2 + 2p - 1}{(p+2)(p-4)^2}.$$

9.13.

$$F(p) = \frac{p^2 + p + 2}{p^2(p+3)}.$$

9.14.

$$F(p) = \frac{9p^2 + 10p + 2}{(p-1)(p+1)^2}.$$

9.15.

$$F(p) = \frac{p+1}{p^2(p+4)}.$$

9.16.

$$F(p) = \frac{2p^2 + 7p + 4}{(p+2)(p-1)^2}.$$

9.17.

$$F(p) = \frac{2p^2 + 6p + 5}{(p-2)(p+3)^2}.$$

9.18.

$$F(p) = \frac{3p^2 + p + 3}{(p-1)(p+2)^2}.$$

9.19.

$$F(p) = \frac{p^2 + 2p - 6}{(p+3)(p-2)^2}.$$

9.20.

$$F(p) = \frac{p^2 + p + 10}{(p+3)(p-4)^2}.$$

9.21.

$$F(p) = \frac{7p^2 + 7p - 1}{(p+2)(p+1)^2}.$$

9.22.

$$F(p) = \frac{p^2 + 4p + 1}{p^2(p+5)}.$$

9.23.

$$F(p) = \frac{-p^2 + 2p - 3}{p(p-5)^2}.$$

9.24.

$$F(p) = \frac{-p^2 + p - 1}{(p+1)(p-4)^2}.$$

9.25.

$$F(p) = \frac{8p^2 + p + 1}{p^2(p+7)}.$$

9.26.

$$F(p) = \frac{6p^2 + 9}{(p+4)(p-2)^2}.$$

9.27.

$$F(p) = \frac{p^2 - 6}{(p+6)(p-7)^2}.$$

9.28.

$$F(p) = \frac{-6p^2 + p}{(p+2)(p-3)}.$$

9.29.

$$F(p) = \frac{5p + 2}{(p+7)(p-1)^2}.$$

9.30.

$$F(p) = \frac{3p - 2}{(p+3)(p-3)^2}.$$

Задача 10. Найти оригинал по заданному изображению с помощью вычетов.

10.1.

$$F(p) = \frac{2}{p^2 \left(p^2 + p + 1 \right)}.$$

10.2.

$$F(p) = \frac{4}{(p+2)^2 \left(p^2 + p + 4 \right)}.$$

10.3.

$$F(p) = \frac{-1}{p^2 \left(p^2 + 2p + 2 \right)}.$$

10.4.

$$F(p) = \frac{2}{(p-1)^2 \left(p^2 + 3p + 3 \right)}.$$

10.5.

$$F(p) = \frac{1}{p^2 \left(p^2 + 2p + 3 \right)}.$$

10.6.

$$F(p) = \frac{5}{(p-1)^2 \left(p^2 - 2p + 3 \right)}.$$

10.7.

$$F(p) = \frac{6}{p^2 \left(p^2 - 2p + 2 \right)}.$$

10.8.

$$F(p) = \frac{8}{(p-3)^2 \left(p^2 - 3p + 3 \right)}.$$

10.9.

$$F(p) = \frac{3}{p^2 \left(p^2 - p + 1 \right)}.$$

10.10.

$$F(p) = \frac{-3}{(p+4)^2 \left(p^2 - p + 2 \right)}.$$

10.11.

$$F(p) = \frac{-12}{p^2 \left(p^2 + 4p + 5 \right)}.$$

10.12.

$$F(p) = \frac{1}{p^2 \left(p^2 - p + 5 \right)}.$$

10.13.

$$F(p) = \frac{6}{p^2(p^2 + p + 9)}.$$

10.14.

$$F(p) = \frac{3}{(p-7)^2(p^2 + 2p + 9)}.$$

10.15.

$$F(p) = \frac{-8}{p^2(p^2 + 2p + 5)}.$$

10.16.

$$F(p) = \frac{3}{(p+3)^2(p^2 + p + 2)}.$$

10.17.

$$F(p) = \frac{-2}{p^2(p^2 + p + 10)}.$$

10.18.

$$F(p) = \frac{5}{(p-3)^2(p^2 + 3p + 5)}.$$

10.19.

$$F(p) = \frac{-4}{p^2(p^2 - p + 7)}.$$

10.20.

$$F(p) = \frac{-5}{(p-5)(p^2 + 3p + 6)}.$$

10.21.

$$F(p) = \frac{1}{p^2(p^2 + 4p + 5)}.$$

10.22.

$$F(p) = \frac{-2}{p(p^2 - 4p + 7)}.$$

10.23.

$$F(p) = \frac{1}{p^2(p^2 - 4p + 8)}.$$

10.24.

$$F(p) = \frac{2}{(p-3)^2(p^2 + 4p + 5)}.$$

10.25.

$$F(p) = \frac{-3}{p^2(p^2 + 3p + 6)}.$$

10.26.

$$F(p) = \frac{3}{p^2(p^2 + 3p + 2)}.$$

10.27.

$$F(p) = \frac{-2}{(p-2)^2(p^2-p+4)}.$$

10.28.

$$F(p) = \frac{7}{p^2(p^2-p+2)}.$$

10.29.

$$F(p) = \frac{4}{p^2(p^2-3p+2)}.$$

10.30.

$$F(p) = \frac{-1}{p^2(p^2-p+4)}.$$

Задача 11. Найти оригинал по заданному изображению

11.1. $F(p) = \dfrac{4p+5}{(p-2)(p^2+4p+5)} + \dfrac{pe^{-3p}}{p^2+9}.$

11.2. $F(p) = \dfrac{p}{(p+1)(p^2+p+1)} + \dfrac{e^{-3p}}{p-1}.$

11.3. $F(p) = \dfrac{2p}{(p^2+4p+8)^2} + \dfrac{e^{-2p}}{p^2+1}.$

11.4. $F(p) = \dfrac{1}{p(p^2+1)^2} + \dfrac{e^{-2p}}{p^2+1}.$

11.5. $F(p) = \dfrac{p+3}{p^3+2p^2+3p} - \dfrac{e^{-2p}}{p^2}.$

11.6. $F(p) = \dfrac{p}{(p+1)(p^2+4p+5)} + \dfrac{-2e^{-p}}{p-1}.$

11.7. $F(p) = \dfrac{5}{(p-1)(p^2+4p+5)} + \dfrac{2e^{-4p}}{p^2+1}.$

11.8. $F(p) = \dfrac{e^{-\frac{p}{2}} + 1}{\left(p^2 + 1\right)\left(p^2 + 2\right)}$.

11.9. $F(p) = \dfrac{5p}{\left(p+2\right)\left(p^2 - 2p + 2\right)} + \dfrac{e^{-\frac{p}{2}}}{p}$.

11.10. $F(p) = \dfrac{1}{\left(p-2\right)\left(p^2 + 2p + 3\right)} + \dfrac{e^{-p}}{\left(p-1\right)^2 + 1}$.

11.11. $F(p) = \dfrac{p}{\left(p^2 + 4p + 8\right)^2} + \dfrac{e^{-p}}{\left(p-2\right)^2 + 4}$.

11.12. $F(p) = \dfrac{1 + p^3 e^{-p}}{p^3 \left(p^2 - 4\right)}$.

11.13. $F(p) = \dfrac{1}{p\left(p^3 + 1\right)} + \dfrac{e^{-p}}{p-2}$.

11.14. $F(p) = \dfrac{p}{\left(p^2 + 1\right)\left(p^2 - 2\right)} + \dfrac{e^{-3p}}{p^2 + 1}$.

11.15. $F(p) = \dfrac{1}{p^3 - 1} + \dfrac{e^{-p}}{p-3}$.

11.16. $F(p) = \dfrac{2 - 3p}{\left(p-2\right)\left(p^2 - 4p + 5\right)} + \dfrac{1 - e^{-p}}{p}$.

11.17. $F(p) = \dfrac{2p + 3}{\left(p-1\right)\left(p^2 - p + 1\right)} + \dfrac{1 + e^{-2p}}{p^2}$.

11.18. $F(p) = \dfrac{2}{(p+1)(p^2+2p+2)} + \dfrac{e^{-p}}{(p-1)^2+1}$.

11.19. $F(p) = \dfrac{2-p}{(p-1)(p^2-4p+5)} + \dfrac{e^{-p}-e^{-2p}}{p^2}$.

11.20. $F(p) = \dfrac{2-p}{p^3-2p^2+5p} + \dfrac{2p-e^{-p}}{p^2+4}$.

11.21. $F(p) = \dfrac{1-p}{p(p^2+3p+3)} + \dfrac{1-e^{-p}}{p}$.

11.22. $F(p) = \dfrac{2p+1}{(p+1)(p^2+2p+3)} + \dfrac{2e^{-3p}}{p^2-1}$.

11.23. $F(p) = \dfrac{3p+2}{(p+1)(p^2+4p+5)} + \dfrac{pe^{-2p}}{p^2+4}$.

11.24. $F(p) = \dfrac{1}{p^3+p^2+p} + \dfrac{e^{-2p}}{p^3}$.

11.25. $F(p) = \dfrac{p+5}{(p+1)(p^2-2p+5)} + \dfrac{e^{-p}}{p^2-1}$.

11.26. $F(p) = \dfrac{p}{(p^2+1)(p^2+4)} + \dfrac{e^{-2p}}{p^2+1}$.

11.27. $F(p) = \dfrac{1+p^2e^{-p}}{p^2+p^3}$.

11.28. $F(p) = \dfrac{p+4}{p^2+4p+5} + \dfrac{e^{-2p}}{p^2}$.

11.29. $F(p) = \dfrac{4}{p^3 + 8} + \dfrac{pe^{-p}}{p^2 - 1}$.

11.30. $F(p) = \dfrac{6}{p^3 - 8} + \dfrac{e^{-3p}}{p - 1}$.

Задача 12. Найти решение задачи Коши.

12.1.

$x'' + 2x' + x = t^2 + 5t + 4;$

$x(0) = -1, \ x'(0) = 0.$

12.2.

$x' - x = 1;$

$x(0) = -1.$

12.3.

$x'' + 3x' = e^t;$

$x(0) = 0, \ x'(0) = -1.$

12.4.

$x'' + 3x' = e^t;$

$x(0) = 0, \ x'(0) = -1.$

12.5.

$x'' - 4x' + x = 1 - 2e^t;$

$x(0) = 2, \ x'(0) = 1.$

12.6.

$x'' + x = \cos t;$

$x(0) = -1, \ x'(0) = 1.$

12.7.

$x'' + x = 1;$

$x(0) = -1, \ x'(0) = 0.$

12.8.

$x'' + 2x' + x = t^2 + 5t + 4;$

$x(0) = -1, \ x'(0) = 0.$

12.9.

$x' - 4x = 1 - t^2;$

$x(0) = 1.$

12.10.

$x'' - x' - 2x = 2e^t;$

$x(0) = -1, \ x'(0) = 1.$

12.11.

$x''' - x' = t - 1;$

$x(0) = -1, \ x'(0) = 0,$

$x''(0) = 0.$

12.12.

$x'' - x' = te^{2t};$

$x(0) = 0, \ x'(0) = 1.$

12.13.

$x' - x = e^t - 1;$

$x(0) = -1.$

12.14.

$x'' - x' = t^2 - 1;$

$x(0) = -1, \ x'(0) = 0.$

12.15.

$x'' + x' + x = 7e^{2t};$

$x(0) = 1, \ x'(0) = 4.$

12.16.

$x'' + 2x' - x = 3t - 1;$

$x(0) = -1, \ x'(0) = 1.$

12.17.

$x'' + 2x' = 2 + e^t;$

$x(0) = 1, \ x'(0) = 2.$

12.18.

$x'' + 2x' = \sin \dfrac{t}{2};$

$x(0) = 2, \ x'(0) = 1.$

12.19.

$x'' + 4x' + 29x = e^{-2t};$

$x(0) = -2, \ x'(0) = 4.$

12.20.

$2x'' + 5x' = 29\cos t;$

$x(0) = -1, \ x'(0) = 0.$

12.21.

$x'' - 3x' + 2x = e^t;$

$x(0) = 1, \ x'(0) = 0.$

12.22.

$x'' + 4x = \sin 2t;$

$x(0) = 0, \ x'(0) = 1.$

12.23.

$2x'' + 3x' + x = 3e^t;$

$x(0) = 0, \ x'(0) = 1.$

12.24.

$x'' - 2x' - 3x = 2t;$

$x(0) = 1, \ x'(0) = 1.$

12.25.

$x'' - x' + x = 3t - 1;$

$x(0) = -1, \ x'(0) = 0.$

12.26.

$x'' + x' - 2x = -2(t + 1);$

$x(0) = 0, \ x'(0) = 0.$

12.27.

$x'' + 2x' + x = t^2 + 5t + 4;$

$x(0) = -1, \ x'(0) = 0.$

12.28.

$x'' - x' + x = t^2 - 2;$

$x(0) = -1, \ x'(0) = 0.$

12.29.

$x'' - x' = te^t;$

$x(0) = 0, \ x'(0) = 0.$

12.30.

$x'' - x = 1;$

$x(0) = -1, \ x'(0) = 0.$

Задача 13. Решить систему дифференциальных уравнений.

13.1.

$\begin{cases} x' = x + 3y + 2, \\ y' = x - y + 1; \end{cases}$

$x(0) = -1, \ y(0) = 2.$

13.2.

$\begin{cases} x' = -x + 3y + 1, \\ y' = x + y; \end{cases}$

$x(0) = 1, \ y(0) = 2.$

13.3.

$$\begin{cases} x' = x + 4y, \\ y' = 2x - y + 9; \end{cases}$$

$x(0) = 1, \ y(0) = 0.$

13.4.

$$\begin{cases} x' = x + 2y + 1, \\ y' = 4x - y; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.5.

$$\begin{cases} x' = 3x + y, \\ y' = -5x - 3y + 2; \end{cases}$$

$x(0) = 2, \ y(0) = 0.$

13.6.

$$\begin{cases} x' = -4y - 3x + 1, \\ y' = 2x + 3y; \end{cases}$$

$x(0) = 0, \ y(0) = 2.$

13.7.

$$\begin{cases} x' = 2x + 5y, \\ y' = x - 2y + 2; \end{cases}$$

$x(0) = 1, \ y(0) = 1.$

13.8.

$$\begin{cases} x' = -2x + 5y + 1, \\ y' = x + 2y + 1; \end{cases}$$

$x(0) = 0, \ y(0) = 2.$

13.9.

$$\begin{cases} x' = 2x + 3y + 1, \\ y' = 4x - 2y; \end{cases}$$

$x(0) = -1, \ y(0) = 0.$

13.10.

$$\begin{cases} x' = -2x + 6y + 1, \\ y' = 2x + 2; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.11.

$$\begin{cases} x' = -x - 2y + 1, \\ y' = -\dfrac{3}{2}x + y; \end{cases}$$

$x(0) = 1, \ y(0) = 0.$

13.12.

$$\begin{cases} x' = 3x + 2y, \\ y' = \dfrac{5}{2}x - y + 2; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.13.

$$\begin{cases} x' = 2x + 2y + 2, \\ y' = 4y + 1; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.14.

$$\begin{cases} x' = 3x + 5y + 2, \\ y' = 3x + y + 1; \end{cases}$$

$x(0) = 0, \ y(0) = 2.$

13.15.

$$\begin{cases} x' = 2y, \\ y' = 2x + 3y + 1; \end{cases}$$

$x(0) = 2, \ y(0) = 1.$

13.16.

$$\begin{cases} x' = -2x + y + 2, \\ y' = 3x; \end{cases}$$

$x(0) = 1, \ y(0) = 0.$

13.17.

$$\begin{cases} x' = y + 3, \\ y' = x + 2; \end{cases}$$

$x(0) = 1, y(0) = 0.$

13.18.

$$\begin{cases} x' = 3y, \\ y' = 3x + 1; \end{cases}$$

$x(0) = 2, \ y(0) = 0.$

13.19.

$$\begin{cases} x' = 2x + 8y + 1, \\ y' = 3x + 4y; \end{cases}$$

$x(0) = 2, \ y(0) = 1.$

13.20.

$$\begin{cases} x' = 2y + 1, \\ y' = 2x + 3; \end{cases}$$

$x(0) = -1, \ y(0) = 0.$

13.21.

$$\begin{cases} x' = x + 4y + 1, \\ y' = 2x + 3y; \end{cases}$$

$x(0) = 0, \ y(0) = 0.$

13.22.

$$\begin{cases} x' = x + y, \\ y' = 4x + y + 1; \end{cases}$$

$x(0) = 1, \ y(0) = 1.$

13.23.

$$\begin{cases} x' = x + 3y + 3, \\ y' = x - y + 1; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.24.

$$\begin{cases} x' = x + 3y, \\ y' = x - y; \end{cases}$$

$x(0) = 1, \ y(0) = 0.$

13.25.

$$\begin{cases} x' = -x + 3y + 2, \\ y' = x + y + 1; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.26.

$$\begin{cases} x' = 4x + 3, \\ y' = x + 2y; \end{cases}$$

$x(0) = -1, \ y(0) = 0.$

13.27.

$$\begin{cases} x' = x - 2y + 1, \\ y' = -3x; \end{cases}$$

$x(0) = 0, \ y(0) = 1.$

13.28.

$$\begin{cases} x' = 3y + 2, \\ y' = x + 2y; \end{cases}$$

$x(0) = -1, \ y(0) = 1.$

13.29.

$$\begin{cases} x' = 2x - 2y, \\ y' = -4x; \end{cases}$$

$x(0) = 3, \ y(0) = 1.$

13.30.

$$\begin{cases} x' = x + 2y, \\ y' = 2x + y + 1; \end{cases}$$

$x(0) = 0, \ y(0) = 5.$