```
> restart; with(Student[VectorCalculus]) : with(Student[Calculus1]) : with(plots) :
      infolevel[Student[Calculus1]] := 1 : with(geom3d) :
```

ЗАДАЧА # 17

Дано

```
> VF17 := VectorField((( -27 x + 11 y + 72), ( -51 x - 33 y + 81)))
```

$$VF_{17} := (-27x + 11y + 72)\bar{e}_x + (-51x - 33y + 81)\bar{e}_y \quad (1)$$

```
> CF := LineSegments(⟨-3, 5⟩, ⟨-4, 5⟩, ⟨-4, 1⟩, ⟨-3, 5⟩)
```

$$CF := LineSegments(-3e_x + 5e_y, -4e_x + 5e_y, -4e_x + e_y, -3e_x + 5e_y) \quad (2)$$

Найти: $\int_C \mathbf{F} \cdot \mathbf{dx} = \sum_{i=1}^{n} \int_C F_i \, dx_i$

РЕШЕНИЕ.

Режем на сегменты

```
> first := (op(CF)1)1, (op(CF)1)2
```

$$first := -3, 5 \quad (3)$$

```
> second := (op(CF)2)1, (op(CF)2)2
```

$$second := -4, 5 \quad (4)$$

```
> third := (op(CF)3)1, (op(CF)3)2
```

$$third := -4, 1 \quad (5)$$

Определяем точки по границам сегментов

```
> point(A, first, 0)
```

$$A \quad (6)$$

```
> point(B, second, 0)
```

$$B \quad (7)$$

```
> point(C, third, 0)
```

$$C \quad (8)$$

```
> line(AB, [A, B]), line(BC, [B, C]), line(CA, [C, A])
```

$$AB, BC, CA \quad (9)$$

Составляем параметрические уравнения прямых

```
> Equation(AB,'t'), Equation(BC,'t'), Equation(CA,'t')
```

$$[-3 - t, 5, 0], [-4, 5 - 4t, 0], [-4 + t, 1 + 4t, 0] \quad (10)$$

Вычисляем интегралы вдоль указанных сегментов

```
> LineAB := [x = op(Equation(AB,'t'))1, y = op(Equation(AB,'t'))2, z = op(Equation(AB,'t'))3]
```

$$LineAB := [x = -3 - t, y = 5, z = 0] \quad (11)$$

```
> #LineInt(VF17, LineSegments(⟨first⟩, ⟨second⟩), output = plot, scaling = constrained)
> LineBC := [x = op(Equation(BC,'t'))1, y = op(Equation(BC,'t'))2, z = op(Equation(BC,'t'))3]
```

$$LineBC := [x = -4, y = 5 - 4t, z = 0] \quad (12)$$

```
> #LineInt(VF17, LineSegments(⟨second⟩, ⟨third⟩), output = plot, scaling = constrained)
```

> $LineCA := [x = op(Equation(CA,'t'))_1, y = op(Equation(CA,'t'))_2, z = op(Equation(CA,'t'))_3]$

$$LineCA := [x = -4 + t, y = 1 + 4\,t, z = 0] \quad (13)$$

> $\#LineInt(VF_{17}, LineSegments(\langle third\rangle, \langle first\rangle), output = plot, scaling = constrained)$

>

Вот подынтегральные функции

> $\left(eval\left((VF_{17})_1, LineAB\right) \cdot \frac{d}{dt} Equation(AB,'t')_1 + eval\left((VF_{17})_2, LineAB\right) \cdot \frac{d}{dt} Equation(AB,'t')_2\right)$

$$-208 - 27\,t \quad (14)$$

> $\left(eval\left((VF_{17})_1, LineBC\right) \cdot \frac{d}{dt} Equation(BC,'t')_1 + eval\left((VF_{17})_2, LineBC\right) \cdot \frac{d}{dt} Equation(BC,'t')_2\right)$

$$-480 - 528\,t \quad (15)$$

> $\left(eval\left((VF_{17})_1, LineCA\right) \cdot \frac{d}{dt} Equation(CA,'t')_1 + eval\left((VF_{17})_2, LineCA\right) \cdot \frac{d}{dt} Equation(CA,'t')_2\right)$

$$1199 - 715\,t \quad (16)$$

Вот интегралы

> $J_1 := \int_0^1 \left(eval\left((VF_{17})_1, LineAB\right) \cdot \frac{d}{dt} Equation(AB,'t')_1 + eval\left((VF_{17})_2, LineAB\right) \cdot \frac{d}{dt} Equation(AB,'t')_2\right) dt$

$$J_1 := -\frac{443}{2} \quad (17)$$

> $J_2 := \int_0^1 \left(eval\left((VF_{17})_1, LineBC\right) \cdot \frac{d}{dt} Equation(BC,'t')_1 + eval\left((VF_{17})_2, LineBC\right) \cdot \frac{d}{dt} Equation(BC,'t')_2\right) dt$

$$J_2 := -744 \quad (18)$$

> $J_3 := \int_0^1 \left(eval\left((VF_{17})_1, LineCA\right) \cdot \frac{d}{dt} Equation(CA,'t')_1 + eval\left((VF_{17})_2, LineCA\right) \cdot \frac{d}{dt} Equation(CA,'t')_2\right) dt$

$$J_3 := \frac{1683}{2} \quad (19)$$

Результат

> $add(J_i, i = 1..3)$

$$-124 \quad (20)$$

Теперь еще раз тоже самое, но зараз

```
> Countur17 := LineSegments(⟨-3, 5⟩, ⟨-4, 5⟩, ⟨-4, 1⟩, ⟨-3, 5⟩);
  Task17 := LineInt(VF17, Countur17,'output'='integral');
  gra17 := LineInt(VF17, Countur17, output = plot, scaling = constrained) :
```

$$Countur_{17} := LineSegments(-3e_x + 5e_y, -4e_x + 5e_y, -4e_x + e_y, -3e_x + 5e_y)$$

$$Task_{17} := \int_0^1 (-208 - 27\,t)\,dt + \int_0^1 (-480 - 528\,t)\,dt + \int_0^1 (1199 - 715\,t)\,dt \qquad \textbf{(21)}$$

```
> value( Task17)
```

$$-124 \qquad \textbf{(22)}$$

```
> display(gra17) :
> print(value( Task17) )
```

$$-124 \qquad \textbf{(23)}$$

```
> #printf("Детали решения:"); ShowSolution(Task17); printf("Ответ:");
      print(value( Task17) ) :
>
```