17.1 Homework

① $\oint_C xy\,dx + y\,dy$

→ unit circle : $r=1$

→ $x=\cos\theta$, $y=\sin\theta$, $0\le\theta\le 2\pi$

→ $\int_0^{-2\pi} -\cos\theta\sin^2\theta\,d\theta + \sin\theta\cos\theta\,d\theta = 0$

→ $P(x,y)=xy$, $Q(x,y)=y$

→ $P_y=x$, $Q_x=0$

→ Theorem works

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③ $\oint_C y^2\,dx + x^2\,dy$

→ $P(x,y)=y^2$, $Q(x,y)=x^2$

→ $P_y=2y$, $Q_x=2x$

→ $\int_0^1\int_0^1 (2x-2y)\,dx\,dy = 0$

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⑤ $\oint_C x^2 y\,dx$

→ $P(x,y)=x^2y$, $Q(x,y)=0$

→ $-\frac{\pi}{4}$

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⑦ $\oint_C F\,dr$

→ $F(x,y)=\langle x^2, x^2\rangle$, $C \Rightarrow y=x^2$ & $y=x$, $0\le x\le 1$

→ $\oint_C x^2\,dx + x^2\,dy$

→ $\int_0^1\int_{x^2}^{x} 2x\,dy\,dx = \frac{1}{6}$

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⑨ $F=\langle e^{x+y}, e^{x-y}\rangle$

→ $A=(0,0)$, $B=(2,2)$, $C=(4,2)$, $D=(2,0)$

→ $\oint_C e^{x+y}\,dx + e^{x-y}\,dy$

→ $\int_0^a \int_y^{y+2} (e^{x-y} - e^{x+y})\,dx\,dy = \frac{-(e^2-1)(e^4-5)}{2}$

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(13) $I = \int_C (\sin x + y)\,dx + (3x+y)\,dy$

→ Unsure

17.2 Homework

① $F = \langle 2xy, x, y+z \rangle$, $z = 1-x^2-y^2$, $x^2+y^2 \le 1$

→ $curl(F) = \langle 1, 0, 1-2x \rangle$

→ $\int_{-1}^{1} \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} (-2x+1-2x)\, dy\, dx = \pi$

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③ $F = \langle e^{y-2}, 0, 0 \rangle$, $0 \le x \le 1$, $0 \le y \le 1$, $z = 1$

→ $curl(F) = \langle 0, -e^{y-2}, -e^{y-2} \rangle$

→ $\int_0^1 \int_0^1 (-e^{y-1})\, dx\, dy = e^{-1} - 1$

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⑤ $F = \langle e^{z^2} - y, e^{z^2} + x, \cos(xz) \rangle$, $x^2+y^2+z^2 = 1$, $z \ge 0$

→ Unsure

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⑨ $curl(F) = \langle 0, 0, 0 \rangle$

→ $\iint_S curl(F) \cdot dS = 0$

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⑪ $F = \langle 3y, -2x, 3y \rangle$, $x^2+y^2 = 9$, $z = 2$

→ $curl(F) = \langle 3, 0, -5 \rangle$

→ $\iint_S curl(F)\, dS = -45\pi$

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⑬ $F = \langle y, z, x \rangle$

→ $\iint_S curl(F)\, dS = 0$
