

Bài tập phương trình vi phân: Thầy Trịnh Ngọc Hải

A. Phương trình cấp 1

1. Phương trình phân ly biến số: Bài tập:51-65

51. $xy \, dx + (x + 1) \, dy = 0$.
52. $\sqrt{y^2 + 1} \, dx = xy \, dy$.
53. $(x^2 - 1)y' + 2xy^2 = 0$; $y(0) = 1$.
54. $y' \operatorname{ctg} x + y = 2$; $y(x) \rightarrow -1$ при $x \rightarrow 0$.
55. $y' = 3\sqrt[3]{y^2}$; $y(2) = 0$.
56. $xy' + y = y^2$; $y(1) = 0,5$.
57. $2x^2yy' + y^2 = 2$. 58. $y' - xy^2 = 2xy$.
59. $e^{-s} \left(1 + \frac{ds}{dt}\right) = 1$. 60. $z' = 10^{x+z}$.
61. $x \frac{dx}{dt} + t = 1$. 62. $y' = \cos(y - x)$.
63. $y' - y = 2x - 3$.
64. $(x + 2y)y' = 1$; $y(0) = -1$.
65. $y' = \sqrt{4x + 2y - 1}$.

2. Phương trình đẳng cấp: Bài tập:101-129

101. $(x + 2y) \, dx - x \, dy = 0$.
102. $(x - y) \, dx + (x + y) \, dy = 0$.
103. $(y^2 - 2xy) \, dx + x^2 \, dy = 0$.
104. $2x^3y' = y(2x^2 - y^2)$.
105. $y^2 + x^2y' = xyy'$.
106. $(x^2 + y^2)y' = 2xy$.
107. $xy' - y = x \operatorname{tg} \frac{y}{x}$.
108. $xy' = y - xe^{y/x}$.
109. $xy' - y = (x + y) \ln \frac{x+y}{x}$.
110. $xy' = y \cos \ln \frac{y}{x}$.
111. $(y + \sqrt{xy}) \, dx = x \, dy$.
112. $xy' = \sqrt{x^2 - y^2} + y$.
113. $(2x - 4y + 6) \, dx + (x + y - 3) \, dy = 0$.
114. $(2x + y + 1) \, dx - (4x + 2y - 3) \, dy = 0$.
115. $x - y - 1 + (y - x + 2)y' = 0$.
116. $(x + 4y)y' = 2x + 3y - 5$.
117. $(y + 2) \, dx = (2x + y - 4) \, dy$.
118. $y' = 2 \left(\frac{y + 2}{x + y - 1} \right)^2$.
119. $(y' + 1) \ln \frac{y + x}{x + 3} = \frac{y + x}{x + 3}$.
120. $y' = \frac{y + 2}{x + 1} + \operatorname{tg} \frac{y - 2x}{x + 1}$.
121. $x^3(y' - x) = y^2$.
122. $2x^2y' = y^3 + xy$.
123. $2x \, dy + (x^2y^4 + 1)y \, dx = 0$.
124. $y \, dx + x(2xy + 1) \, dy = 0$.
125. $2y' + x = 4\sqrt{y}$.
126. $y' = y^2 - \frac{2}{x^2}$.
127. $2xy' + y = y^2 \sqrt{x - x^2y^2}$.
128. $\frac{2}{3}xyy' = \sqrt{x^6 - y^4} + y^2$.
129. $2y + (x^2y + 1)xy' = 0$.

3. Phương trình tuyến tính cấp 1: Bài tập:137-171

- 137.** $(2x + 1)y' = 4x + 2y$.
138. $y' + y \operatorname{tg} x = \sec x$.
139. $(xy + e^x) dx - x dy = 0$.
140. $x^2 y' + xy + 1 = 0$.
141. $y = x(y' - x \cos x)$.
142. $2x(x^2 + y) dx = dy$.
143. $(xy' - 1) \ln x = 2y$.
144. $xy' + (x + 1)y = 3x^2 e^{-x}$.
145. $(x + y^2) dy = y dx$.
146. $(2e^y - x)y' = 1$.
147. $(\sin^2 y + x \operatorname{ctg} y)y' = 1$.
148. $(2x + y) dy = y dx + 4 \ln y dy$.
149. $y' = \frac{y}{3x - y^2}$.

- 150.** $(1 - 2xy)y' = y(y - 1)$.
151. $y' + 2y = y^2 e^x$.
152. $(x + 1)(y' + y^2) = -y$.
153. $y' = y^4 \cos x + y \operatorname{tg} x$.
154. $xy^2 y' = x^2 + y^3$.
155. $xy dy = (y^2 + x) dx$.
156. $xy' - 2x^2 \sqrt{y} = 4y$.
157. $xy' + 2y + x^5 y^3 e^x = 0$.
158. $2y' - \frac{x}{y} = \frac{xy}{x^2 - 1}$.
159. $y' x^3 \sin y = xy' - 2y$.
160. $(2x^2 y \ln y - x)y' = y$.

- 161.** $x dx = (x^2 - 2y + 1) dy$.
162. $(x + 1)(yy' - 1) = y^2$.
163. $x(e^y - y') = 2$.
164. $(x^2 - 1)y' \sin y + 2x \cos y = 2x - 2x^3$.
165. $y(x) = \int_0^x y(t) dt + x + 1$.
166. $\int_0^x (x - t)y(t) dt = 2x + \int_0^x y(t) dt$.
167. $x^2 y' + xy + x^2 y^2 = 4$.
168. $3y' + y^2 + \frac{2}{x^2} = 0$.
169. $xy' - (2x + 1)y + y^2 = -x^2$.
170. $y' - 2xy + y^2 = 5 - x^2$.
171. $y' + 2ye^x - y^2 = e^{2x} + e^x$.

4. Phương trình vi phân toàn phần: Bài tập:186-220

- 186.** $2xy dx + (x^2 - y^2) dy = 0$.
187. $(2 - 9xy^2)x dx + (4y^2 - 6x^3)y dy = 0$.
188. $e^{-y} dx - (2y + xe^{-y}) dy = 0$.
189. $\frac{y}{x} dx + (y^3 + \ln x) dy = 0$.
190. $\frac{3x^2 + y^2}{y^2} dx - \frac{2x^3 + 5y}{y^3} dy = 0$.
191. $2x \left(1 + \sqrt{x^2 - y}\right) dx - \sqrt{x^2 - y} dy = 0$.
192. $(1 + y^2 \sin 2x) dx - 2y \cos^2 x dy = 0$.
193. $3x^2(1 + \ln y) dx = \left(2y - \frac{x^3}{y}\right) dy$.
194. $\left(\frac{x}{\sin y} + 2\right) dx + \frac{(x^2 + 1) \cos y}{\cos 2y - 1} dy = 0$.
195. $(x^2 + y^2 + x) dx + y dy = 0$.
196. $(x^2 + y^2 + y) dx - x dy = 0$.
197. $y dy = (x dy + y dx) \sqrt{1 + y^2}$.
198. $xy^2(xy' + y) = 1$.
199. $y^2 dx - (xy + x^3) dy = 0$.
200. $\left(y - \frac{1}{x}\right) dx + \frac{dy}{y} = 0$.
201. $(x^2 + 3 \ln y)y dx = x dy$.
202. $y^2 dx + (xy + \operatorname{tg} xy) dy = 0$.
203. $y(x + y) dx + (xy + 1) dy = 0$.
204. $y(y^2 + 1) dx + x(y^2 - x + 1) dy = 0$.
205. $(x^2 + 2x + y) dx = (x - 3x^2 y) dy$.
206. $y dx - x dy = 2x^3 \operatorname{tg} \frac{y}{x} dx$.

$$207. y^2 dx + (e^x - y) dy = 0.$$

$$208. xy dx = (y^3 + x^2 y + x^2) dy.$$

$$209. x^2 y (y dx + x dy) = 2y dx + x dy.$$

$$210. (x^2 - y^2 + y) dx + x(2y - 1) dy = 0.$$

$$211. (2x^2 y^2 + y) dx + (x^3 y - x) dy = 0.$$

$$212. (2x^2 y^3 - 1)y dx + (4x^2 y^3 - 1)x dy = 0.$$

$$213. y(x + y^2) dx + x^2(y - 1) dy = 0.$$

$$214. (x^2 - \sin^2 y) dx + x \sin 2y dy = 0.$$

$$215. x(\ln y + 2 \ln x - 1) dy = 2y dx.$$

$$216. (x^2 + 1)(2x dx + \cos y dy) = 2x \sin y dx.$$

$$217. (2x^3 y^2 - y) dx + (2x^2 y^3 - x) dy = 0.$$

$$218. x^2 y^3 + y + (x^3 y^2 - x)y' = 0.$$

$$219. (x^2 - y) dx + x(y + 1) dy = 0.$$

$$220. y^2(y dx - 2x dy) = x^3(x dy - 2y dx).$$

5. Phương trình không giải được đối với đạo hàm: Bài tập:241-296

$$241. y'^2 - y^2 = 0.$$

$$242. 8y'^3 = 27y.$$

$$243. (y' + 1)^3 = 27(x + y)^2.$$

$$245. y^2(y'^2 + 1) = 1.$$

$$245. y'^2 - 4y^3 = 0.$$

$$246. y'^2 = 4y^3(1 - y).$$

$$247. xy'^2 = y.$$

$$245. yy'^3 + x = 1.$$

$$249. y'^3 + y^2 = yy'(y' + 1).$$

$$250. 4(1 - y) = (3y - 2)^2 y'^2.$$

$$251. y'^2 + xy = y^2 + xy'.$$

$$252. xy'(xy' + y) = 2y^2.$$

$$253. xy'^2 - 2yy' + x = 0.$$

$$254. xy'^2 = y(2y' - 1).$$

$$255. y'^2 + x = 2y.$$

$$256. y'^3 + (x + 2)e^y = 0.$$

$$257. y'^2 - 2xy' = 8x^2.$$

$$258. (xy' + 3y)^2 = 7x.$$

$$259. y'^2 - 2yy' = y^2(e^x - 1).$$

$$260. y'(2y - y') = y^2 \sin^2 x.$$

$$261. y'^4 + y^2 = y^4.$$

$$262. x(y - xy')^2 = xy'^2 - 2yy'.$$

$$263. y(xy' - y)^2 = y - 2xy'.$$

$$264. yy'(yy' - 2x) = x^2 - 2y^2.$$

$$265. y'^2 + 4xy' - y^2 - 2x^2 y = x^4 - 4x^2.$$

$$266. y(y - 2xy')^2 = 2y'.$$

$$\begin{array}{ll}
267. x = y'^3 + y'. & 268. x(y'^2 - 1) = 2y'. \\
269. x = y' \sqrt{y'^2 + 1}. & 270. y'(x - \ln y') = 1. \\
271. y = y'^2 + 2y'^3. & 272. y = \ln(1 + y'^2). \\
273. (y' + 1)^3 = (y' - y)^2. & 274. y = (y' - 1)e^{y'}. \\
275. y'^4 - y'^2 = y^2. & 276. y'^2 - y'^3 = y^2. \\
277. y'^4 = 2yy' + y^2. & 278. y'^2 - 2xy' = x^2 - 4y. \\
279. 5y + y'^2 = x(x + y'). & 280. x^2y'^2 = xy y' + 1. \\
281. y'^3 + y^2 = xy y'. & 282. 2xy' - y = y' \ln yy'. \\
283. y' = e^{xy'/y}. & 284. y = xy' - x^2y'^3.
\end{array}$$

$$285. y = 2xy' + y^2y'^3. \quad 286. y(y - 2xy')^3 = y'^2.$$

Решить уравнения Лагранжа и Клеро (задачи 287—296).

$$\begin{array}{ll}
287. y = xy' - y'^2. & 288. y + xy' = 4\sqrt{y'}. \\
289. y = 2xy' - 4y'^3. & 290. y = xy' - (2 + y'). \\
291. y'^3 = 3(xy' - y). & 292. y = xy'^2 - 2y'^3. \\
293. xy' - y = \ln y'. & 294. xy'(y' + 2) = y. \\
295. 2y'^2(y - xy') = 1. & 296. 2xy' - y = \ln y'.
\end{array}$$

6. Các dạng phương trình bậc nhất khác: Bài tập:301-420

$$\begin{array}{ll}
301. xy' + x^2 + xy - y = 0. & 302. 2xy' + y^2 = 1. \\
303. (2xy^2 - y) dx + x dy = 0. & \\
304. (xy' + y)^2 = x^2y'. & 305. y - y' = y^2 + xy'. \\
306. (x + 2y^3)y' = y. & 307. y'^3 - y'e^{2x} = 0. \\
308. x^2y' = y(x + y). & \\
309. (1 - x^2) dy + xy dx = 0. & \\
310. y'^2 + 2(x - 1)y' - 2y = 0. & \\
311. y + y' \ln^2 y = (x + 2 \ln y)y'. & \\
312. x^2y' - 2xy = 3y. & \\
313. x + yy' = y^2(1 + y'^2). & \\
314. y = (xy' + 2y)^2. & 315. y' = \frac{1}{x - y^2}. \\
316. y'^3 + (3x - 6)y' = 3y. & 317. x - \frac{y}{y'} = \frac{2}{y}. \\
318. 2y'^3 - 3y'^2 + x = y. & 319. (x + y)^2y' = 1. \\
320. 2x^3yy' + 3x^2y^2 + 7 = 0. & \\
321. \frac{dx}{x} = \left(\frac{1}{y} - 2x\right) dy. & \\
322. xy' = e^y + 2y'. & \\
323. 2(x - y^2) dy = y dx. &
\end{array}$$

$$323. 2(x - y^2) dy = y dx.$$

$$324. x^2 y'^2 + y^2 = 2x(2 - yy').$$

$$325. dy + (xy - xy^3) dx = 0.$$

$$326. 2x^2 y' = y^2(2xy' - y).$$

$$327. \frac{y - xy'}{x + yy'} = 2.$$

$$328. x(x - 1)y' + 2xy = 1.$$

$$329. xy(xy' - y)^2 + 2y' = 0.$$

$$330. (1 - x^2)y' - 2xy^2 = xy.$$

Решить уравнения 331—420.

$$331. y' + y = xy^3.$$

$$332. (xy^4 - x) dx + (y + xy) dy = 0.$$

$$333. (\sin x + y) dy + (y \cos x - x^2) dx = 0.$$

$$347. (4xy - 3)y' + y^2 = 1.$$

$$348. y' \sqrt{x} = \sqrt{y - x} + \sqrt{x}.$$

$$349. xy' = 2\sqrt{y} \cos x - 2y.$$

$$350. 3y'^4 = y' + y.$$

$$351. y^2(y - xy') = x^3 y'.$$

$$352. y' = (4x + y - 3)^2.$$

$$353. (\cos x - x \sin x) y dx + (x \cos x - 2y) dy = 0.$$

$$354. x^2 y'^2 - 2xyy' = x^2 + 3y^2.$$

$$355. \frac{xy'}{y} + 2xy \ln x + 1 = 0.$$

$$356. xy' = x\sqrt{y - x^2} + 2y.$$

$$357. (1 - x^2 y) dx + x^2(y - x) dy = 0.$$

$$358. (2xe^y + y^4)y' = ye^y.$$

$$334. 3y'^3 - xy' + 1 = 0.$$

$$335. yy' + y^2 \operatorname{ctg} x = \cos x.$$

$$336. (e^y + 2xy) dx + (e^y + x)x dy = 0.$$

$$337. xy'^2 = y - y'.$$

$$338. x(x + 1)(y' - 1) = y.$$

$$339. y(y - xy') = \sqrt{x^4 + y^4}.$$

$$340. xy' + y = \ln y'.$$

$$341. x^2(dy - dx) = (x + y)y dx.$$

$$342. y' + x \sqrt[3]{y} = 3y.$$

$$343. (x \cos y + \sin 2y)y' = 1.$$

$$344. y'^2 - yy' + e^x = 0.$$

$$345. y' = \frac{x}{y} e^{2x} + y.$$

$$346. (xy' - y)^3 = y'^3 - 1.$$

$$359. xy'(\ln y - \ln x) = y.$$

$$360. 2y' = x + \ln y'.$$

$$361. (2x^2 y - 3y^2)y' = 6x^2 - 2xy^2 + 1.$$

$$362. yy' = 4x + 3y - 2.$$

$$363. y^2 y' + x^2 \sin^3 x = y^3 \operatorname{ctg} x.$$

$$364. 2xy' - y = \sin y'.$$

$$365. (x^2 y^2 + 1)y + (xy - 1)^2 xy' = 0.$$

$$366. y \sin x + y' \cos x = 1.$$

$$367. x dy - y dx = x \sqrt{x^2 + y^2} dx.$$

$$368. y^2 + x^2 y'^5 = xy(y'^2 + y'^3).$$

$$369. y' = \sqrt[3]{2x - y} + 2.$$

$$370. \left(x - y \cos \frac{y}{x}\right) dx + x \cos \frac{y}{x} dy = 0.$$

$$371. 2 \left(x^2 y + \sqrt{1 + x^4 y^2}\right) dx + x^3 dy = 0.$$

$$372. (y' - x\sqrt{y})(x^2 - 1) = xy.$$

$$373. y'^3 + (y'^2 - 2y')x = 3y' - y.$$

$$374. (2x + 3y - 1)dx + (4x + 6y - 5)dy = 0.$$

$$375. (2xy^2 - y)dx + (y^2 + x + y)dy = 0.$$

$$376. y = y'\sqrt{1 + y'^2}.$$

$$377. y^2 = (xyy' + 1)\ln x.$$

$$378. 4y = x^2 + y'^2.$$

$$379. 2x dy + y dx + xy^2(x dy + y dx) = 0.$$

$$380. x dx + (x^2 \operatorname{ctg} y - 3 \cos y) dy = 0.$$

$$381. x^2 y'^2 - 2(xy - 2)y' + y^2 = 0.$$

$$382. xy' + 1 = e^{x-y}.$$

$$383. y' = \operatorname{tg}(y - 2x).$$

$$384. 3x^2 - y = y'\sqrt{x^2 + 1}.$$

$$397. y' - 8x\sqrt{y} = \frac{4xy}{x^2 - 1}.$$

$$398. [2x - \ln(y + 1)]dx - \frac{x + y}{y + 1}dy = 0.$$

$$399. xy' = (x^2 + \operatorname{tg} y) \cos^2 y.$$

$$400. x^2(y - xy') = yy'^2.$$

$$401. y' = \frac{3x^2}{x^3 + y + 1}.$$

$$402. y' = \frac{(1 + y)^2}{x(y + 1) - x^2}.$$

$$403. (y - 2xy')^2 = 4yy'^3.$$

$$404. 6x^5 y dx + (y^4 \ln y - 3x^6) dy = 0.$$

$$405. y' = \frac{1}{2}\sqrt{x} + \sqrt[3]{y}.$$

$$406. 2xy' + 1 = y + \frac{x^2}{y - 1}.$$

$$416. (xy' - y)^2 = y'^2 - \frac{2yy'}{x} + 1.$$

$$417. (x + y)(1 - xy) dx + (x + 2y) dy = 0.$$

$$418. (3xy + x + y)y dx + (4xy + x + 2y)x dy = 0.$$

$$419. (x^2 - 1) dx + (x^2 y^2 + x^3 + x) dy = 0.$$

$$420. x(y'^2 + e^{2y}) = -2y'.$$

$$385. yy' + xy = x^3.$$

$$386. x(x - 1)y' + y^3 = xy.$$

$$387. xy' = 2y + \sqrt{1 + y'^2}.$$

$$388. (2x + y + 5)y' = 3x + 6.$$

$$389. y' + \operatorname{tg} y = x \sec y.$$

$$390. y'^4 = 4y(xy' - 2y)^2.$$

$$391. y' = \frac{y^2 - x}{2y(x + 1)}.$$

$$392. xy' = x^2 e^{-y} + 2.$$

$$393. y' = 3x + \sqrt{y - x^2}.$$

$$394. x dy - 2y dx + xy^2(2x dy + y dx) = 0.$$

$$395. (x^3 - 2xy^2) dx + 3x^2 y dy = x dy - y dx.$$

$$396. (yy')^3 = 27x(y^2 - 2x^2).$$

$$407. yy' + x = \frac{1}{2} \left(\frac{x^2 + y^2}{x} \right)^2.$$

$$408. y' = \left(\frac{3x + y^3 - 1}{y} \right)^2.$$

$$409. (x\sqrt{y^2 + 1} + 1)(y^2 + 1) dx = xy dy.$$

$$410. (x^2 + y^2 + 1)yy' + (x^2 + y^2 - 1)x = 0.$$

$$411. y^2(x - 1) dx = x(xy + x - 2y) dy.$$

$$412. (xy' - y)^2 = x^2 y^2 - x^4.$$

$$413. xyy' - x^2 \sqrt{y^2 + 1} = (x + 1)(y^2 + 1).$$

$$414. (x^2 - 1)y' + y^2 - 2xy + 1 = 0.$$

$$415. y' \operatorname{tg} y + 4x^3 \cos y = 2x.$$

B. Phương trình cấp 2

1. Phương trình bậc 2 hạ cấp được: Bài tập: 423-505

423. $y^3 y'' = 1$.

425. $y'' = 2yy'$.

427. $y''(e^x + 1) + y' = 0$.

429. $yy'' = y'^2 - y'^3$.

431. $2yy'' = y^2 + y'^2$.

433. $y''^2 + y' = xy''$.

435. $xy''' = y'' - xy''$.

437. $y'' = e^y$.

439. $2y'(y'' + 2) = xy''^2$.

441. $y'^2 = (3y - 2y')y''$.

443. $y''^2 - 2y'y''' + 1 = 0$.

444. $(1 - x^2)y'' + xy' = 2$.

445. $yy'' - 2yy' \ln y = y'^2$.

446. $(y' + 2y)y'' = y'^2$.

448. $y'''y'^2 = y''^3$.

450. $xy'' = y' + x(y'^2 + x^2)$.

451. $xy^{\text{IV}} = 1$.

453. $y''' = 2xy''$.

424. $y'^2 + 2yy'' = 0$.

426. $yy'' + 1 = y'^2$.

428. $y''' = y''^2$.

430. $y''' = 2(y'' - 1) \operatorname{ctg} x$.

432. $y''^3 + xy'' = 2y'$.

434. $y'' + y'^2 = 2e^{-y}$.

436. $y''^2 = y'^2 + 1$.

438. $y'' - xy''' + y'''^3 = 0$.

440. $y^4 - y^3 y'' = 1$.

442. $y''(2y' + x) = 1$.

447. $xy'' = y' + x \sin \frac{y'}{x}$.

449. $yy'' + y = y'^2$.

452. $xy'' = \sin x$.

454. $xy^{\text{IV}} + y''' = e^x$.

461. $xy'' = 2yy' - y'$.

462. $xy'' - y' = x^2 yy'$.

463. $xyy'' - xy'^2 = yy'$.

464. $yy'' = y'^2 + 15y^2 \sqrt{x}$.

465. $(x^2 + 1)(y'^2 - yy'') = xyy'$.

466. $xyy'' + xy'^2 = 2yy'$.

467. $x^2 yy'' = (y - xy')^2$.

468. $y'' + \frac{y'}{x} + \frac{y}{x^2} = \frac{y'^2}{y}$.

469. $y(xy'' + y') = xy'^2(1 - x)$.

470. $x^2 yy'' + y'^2 = 0$.

471. $x^2(y'^2 - 2yy'') = y^2$.

472. $xyy'' = y'(y + y')$.

473. $4x^2 y^3 y'' = x^2 - y^4$.

474. $x^3 y'' = (y - xy')(y - xy' - x)$.

475. $\frac{y^2}{x^2} + y'^2 = 3xy'' + \frac{2yy'}{x}$.

476. $y'' = \left(2xy - \frac{5}{x}\right)y' + 4y^2 - \frac{4y}{x^2}$.

477. $x^2(2yy'' - y'^2) = 1 - 2xyy'$.

478. $x^2(yy'' - y'^2) + xyy' = (2xy' - 3y)\sqrt{x^3}$.

479. $x^4(y'^2 - 2yy'') = 4x^3 yy' + 1$.

480. $yy' + xyy'' - xy'^2 = x^3$.

456. $y'y''' = 2y''^2$.

458. $5y'''^2 - 3y''y^{\text{IV}} = 0$.

460. $y'' = xy' + y + 1$.

455. $yy''' + 3y'y'' = 0$.

457. $yy'' = y'(y' + 1)$.

459. $yy'' + y'^2 = 1$.

481. $y''(3 + yy'^2) = y'^4$. 482. $y''^2 - y'y''' = \left(\frac{y'}{x}\right)^2$.
483. $yy' + 2x^2y'' = xy'^2$. 484. $y'^2 + 2xyy'' = 0$.
485. $2xy^2(xy'' + y') + 1 = 0$.
486. $x(y'' + y'^2) = y'^2 + y'$.
487. $y^2(y'y''' - 2y''^2) = y'^4$.
488. $y(2xy'' + y') = xy'^2 + 1$.
489. $y'' + 2yy'^2 = \left(2x + \frac{1}{x}\right)y'$.
490. $y'y''' = y''^2 + y'^2y''$. 491. $yy'' = y'^2 + 2xy^2$.
492. $y'^4 = y'^5 - yy'^3y''$. 493. $2yy''' = y'$.
494. $y'''y'^2 = 1$. 495. $y^2y''' = y'^3$.
496. $x^2yy'' + 1 = (1 - y)xy'$.
497. $yy'y''' + 2y'^2y'' = 3yy''^2$.
498. $(y'y''' - 3y''^2)y = y'^5$.
499. $y^2(y'y''' - 2y''^2) = yy'^2y'' + 2y'^4$.
500. $x^2(y^2y''' - y'^3) = 2y^2y' - 3xyy'^2$.
501. $yy'' = 2xy'^2$; $y(2) = 2$, $y'(2) = 0,5$.
502. $2y''' - 3y'^2 = 0$; $y(0) = -3$, $y'(0) = 1$, $y''(0) = -1$.
503. $x^2y'' - 3xy' = \frac{6y^2}{x^2} - 4y$; $y(1) = 1$, $y'(1) = 4$.
504. $y''' = 3yy'$; $y(0) = -2$, $y'(0) = 0$, $y''(0) = 4,5$.
505. $y'' \cos y + y'^2 \sin y = y'$; $y(-1) = \frac{\pi}{6}$, $y'(-1) = 2$.

2. Phương trình tuyến tính cấp 2 hệ số biến thiên: Bài tập:511-611

511. $y'' + y' - 2y = 0$. 512. $y'' + 4y' + 3y = 0$. 540. $y'' - 3y' + 2y = x \cos x$.
513. $y'' - 2y' = 0$. 514. $2y'' - 5y' + 2y = 0$. 541. $y'' + 3y' - 4y = e^{-4x} + xe^{-x}$.
515. $y'' - 4y' + 5y = 0$. 516. $y'' + 2y' + 10y = 0$. 542. $y'' + 2y' - 3y = x^2e^x$.
517. $y'' + 4y = 0$. 518. $y''' - 8y = 0$. 543. $y'' - 4y' + 8y = e^{2x} + \sin 2x$.
519. $y^{\text{IV}} - y = 0$. 520. $y^{\text{IV}} + 4y = 0$. 544. $y'' - 9y = e^{3x} \cos x$.
521. $y^{\text{VI}} + 64y = 0$. 522. $y'' - 2y' + y = 0$. 545. $y'' - 2y' + y = 6xe^x$.
523. $4y'' + 4y' + y = 0$. 524. $y^{\text{V}} - 6y^{\text{IV}} + 9y''' = 0$. 546. $y'' + y = x \sin x$.
525. $y^{\text{V}} - 10y''' + 9y' = 0$. 547. $y'' + 4y' + 4y = xe^{2x}$.
526. $y^{\text{IV}} + 2y'' + y = 0$. 548. $y'' - 5y' = 3x^2 + \sin 5x$.
527. $y''' - 3y'' + 3y' - y = 0$.
528. $y''' - y'' - y' + y = 0$.
529. $y^{\text{IV}} - 5y'' + 4y = 0$. 530. $y^{\text{V}} + 8y''' + 16y' = 0$.
531. $y''' - 3y' + 2y = 0$. 532. $y^{\text{IV}} + 4y'' + 3y = 0$.

$$533. y'' - 2y' - 3y = e^{4x}. \quad 534. y'' + y = 4xe^x.$$

$$535. y'' - y = 2e^x - x^2.$$

$$536. y'' + y' - 2y = 3xe^x.$$

$$537. y'' - 3y' + 2y = \sin x.$$

$$538. y'' + y = 4 \sin x.$$

$$539. y'' - 5y' + 4y = 4x^2 e^{2x}.$$

$$549. y'' - 2y' + 2y = e^x + x \cos x.$$

$$550. y'' + 6y' + 10y = 3xe^{-3x} - 2e^{3x} \cos x.$$

$$551. y'' - 8y' + 20y = 5xe^{4x} \sin 2x.$$

$$552. y'' + 7y' + 10y = xe^{-2x} \cos 5x.$$

$$553. y'' - 2y' + 5y = 2xe^x + e^x \sin 2x.$$

$$554. y'' - 2y' + y = 2xe^x + e^x \sin 2x.$$

$$555. y'' - 8y' + 17y = e^{4x}(x^2 - 3x \sin x).$$

$$556. y''' + y' = \sin x + x \cos x.$$

$$557. y''' - 2y'' + 4y' - 8y = e^{2x} \sin 2x + 2x^2.$$

$$558. y'' - 6y' + 8y = 5xe^{2x} + 2e^{4x} \sin x.$$

$$559. y'' + 2y' + y = x(e^{-x} - \cos x).$$

$$560. y''' - y'' - y' + y = 3e^x + 5x \sin x.$$

$$561. y'' - 6y' + 13y = x^2 e^{3x} - 3 \cos 2x.$$

$$562. y'' - 9y = e^{-3x}(x^2 + \sin 3x).$$

$$563. y^{\text{IV}} + y'' = 7x - 3 \cos x.$$

$$564. y'' + 4y = \cos x \cdot \cos 3x.$$

$$565. y''' - 4y'' + 3y' = x^2 + xe^{2x}.$$

$$566. y'' - 4y' + 5y = e^{2x} \sin^2 x.$$

$$567. y'' + 3y' + 2y = e^{-x} \cos^2 x.$$

$$568. y'' - 2y' + 2y = (x + e^x) \sin x.$$

$$569. y^{\text{IV}} + 5y'' + 4y = \sin x \cdot \cos 2x.$$

$$570. y'' - 3y' + 2y = 2^x.$$

$$571. y'' - y = 4 \operatorname{sh} x.$$

$$572. y'' + 4y' + 3y = \operatorname{ch} x.$$

$$573. y'' + 4y = \operatorname{sh} x \cdot \sin 2x.$$

$$574. y'' + 2y' + 2y = \operatorname{ch} x \cdot \sin x.$$

$$575. y'' - 2y' + y = \frac{e^x}{x}.$$

$$576. y'' + 3y' + 2y = \frac{1}{e^x + 1}.$$

$$577. y'' + y = \frac{1}{\sin x}.$$

$$578. y'' + 4y = 2 \operatorname{tg} x.$$

$$579. y'' + 2y' + y = 3e^{-x} \sqrt{x+1}.$$

$$580. y'' + y = 2 \sec^3 x.$$

$$581^*. x^3(y'' - y) = x^2 - 2.$$

$$582. y'' - 2y' + y = 0; y(2) = 1, y'(2) = -2.$$

$$583. y'' + y = 4e^x; y(0) = 4, y'(0) = -3.$$

$$584. y'' - 2y' = 2e^x; y(1) = -1, y'(1) = 0.$$

$$585. y'' + 2y' + 2y = xe^{-x}; y(0) = y'(0) = 0.$$

$$586. y''' - y' = 0; y(0) = 3, y'(0) = -1, y''(0) = 1.$$

587. $y''' - 3y' - 2y = 9e^{2x}$; $y(0) = 0$, $y'(0) = -3$,
 $y''(0) = 3$.

588. $y^{IV} + y'' = 2 \cos x$; $y(0) = -2$, $y'(0) = 1$,
 $y''(0) = y'''(0) = 0$.

В задачах **589—600** решить уравнения Эйлера

589. $x^2 y'' - 4xy' + 6y = 0$.

590. $x^2 y'' - xy' - 3y = 0$.

591. $x^3 y''' + xy' - y = 0$.

592. $x^2 y''' = 2y'$.

593. $x^2 y'' - xy' + y = 8x^3$.

594. $x^2 y'' + xy' + 4y = 10x$.

595. $x^3 y'' - 2xy = 6 \ln x$.

596. $x^2 y'' - 3xy' + 5y = 3x^2$.

597. $x^2 y'' - 6y = 5x^3 + 8x^2$.

598. $x^2 y'' - 2y = \sin \ln x$.

598. $x^2 y'' - 2y = \sin \ln x$.

599. $(x - 2)^2 y'' - 3(x - 2)y' + 4y = x$.

600. $(2x + 3)^3 y''' + 3(2x + 3)y' - 6y = 0$.

601. $y'' + 2y' + y = \cos ix$.

602. $y'' - 2y' + y = xe^x \sin^2 ix$.

603. $y'' + 2iy = 8e^x \sin x$.

604. $y'' + 2iy' - y = 8 \cos x$.

605. $y''' - 8iy = \cos 2x$.

606. $y'' - \frac{2y}{x^2} = 3 \ln(-x)$.

607. $y'' + 2y' + y = xe^x + \frac{1}{xe^x}$.

608. $y'' + 2y' + 5y = e^{-x}(\cos^2 x + \operatorname{tg} x)$.

609. $x^2 y'' - 2y = \frac{3x^2}{x+1}$.

610. $x^2 y'' - xy' + y = \frac{\ln x}{x} + \frac{x}{\ln x}$.

611*. $y'' + y = f(x)$.

3. Phương trình tuyến tính cấp 2 hệ số hằng số: Bài tập: 681-700

$$681. (2x+1)y'' + 4xy' - 4y = 0.$$

$$682. x^2(x+1)y'' - 2y = 0; y_1 = 1 + \frac{1}{x}.$$

$$683. xy'' - (2x+1)y' + (x+1)y = 0.$$

$$684. xy'' + 2y' - xy = 0; y_1 = \frac{e^x}{x}.$$

$$685. y'' - 2(1 + \operatorname{tg}^2 x)y = 0; y_1 = \operatorname{tg} x.$$

$$686. x(x-1)y'' - xy' + y = 0.$$

$$687. (e^x + 1)y'' - 2y' - e^x y = 0; y_1 = e^x - 1.$$

$$688. x^2 y'' \ln x - xy' + y = 0.$$

$$689. y'' - y' \operatorname{tg} x + 2y = 0; y_1 = \sin x.$$

$$690. (x^2 - 1)y'' + (x - 3)y' - y = 0.$$

$$691. xy'' - (x+1)y' - 2(x-1)y = 0.$$

$$692. y'' + 4xy' + (4x^2 + 2)y = 0; y_1 = e^{ax^2}.$$

$$693. xy'' - (2x+1)y' + 2y = 0.$$

$$694. x(2x+1)y'' + 2(x+1)y' - 2y = 0.$$

$$695. x(x+4)y'' - (2x+4)y' + 2y = 0.$$

$$696. x(x^2 + 6)y'' - 4(x^2 + 3)y' + 6xy = 0.$$

$$697. (x^2 + 1)y'' - 2y = 0.$$

$$698. 2x(x+2)y'' + (2-x)y' + y = 0.$$

$$699. xy''' - y'' - xy' + y = 0; y_1 = x, y_2 = e^x.$$

$$700. x^2(2x-1)y''' + (4x-3)xy'' - 2xy' + 2y = 0; \\ y_1 = x, y_2 = 1/x.$$

C. Hệ phương trình

4. Hệ phương trình tuyến tính với hệ số hằng số: Bài tập: 786-873

$$786. \begin{cases} \dot{x} = 2x + y, \\ \dot{y} = 3x + 4y. \end{cases} \quad 787. \begin{cases} \dot{x} = x - y, \\ \dot{y} = y - 4x. \end{cases}$$

$$788. \begin{cases} \dot{x} + x - 8y = 0, \\ \dot{y} - x - y = 0. \end{cases} \quad 789. \begin{cases} \dot{x} = x + y, \\ \dot{y} = 3y - 2x. \end{cases}$$

$$790. \begin{cases} \dot{x} = x - 3y, \\ \dot{y} = 3x + y. \end{cases} \quad 791. \begin{cases} \dot{x} + x + 5y = 0, \\ \dot{y} - x - y = 0. \end{cases}$$

$$792. \begin{cases} \dot{x} = 2x + y, \\ \dot{y} = 4y - x. \end{cases} \quad 793. \begin{cases} \dot{x} = 3x - y, \\ \dot{y} = 4x - y. \end{cases}$$

$$794. \begin{cases} \dot{x} = 2y - 3x, \\ \dot{y} = y - 2x. \end{cases} \quad 795. \begin{cases} \dot{x} - 5x - 3y = 0, \\ \dot{y} + 3x + y = 0. \end{cases}$$

$$796. \begin{cases} \dot{x} = x + z - y, \\ \dot{y} = x + y - z, \\ \dot{z} = 2x - y \end{cases} \quad 797. \begin{cases} \dot{x} = x - 2y - z, \\ \dot{y} = y - x + z, \\ \dot{z} = x - z \end{cases} \\ (\lambda_1 = 1, \lambda_2 = 2, \lambda_3 = -1). \quad (\lambda_1 = 0, \lambda_2 = 2, \lambda_3 = -1).$$

$$798. \begin{cases} \dot{x} = 2x - y + z, \\ \dot{y} = x + 2y - z, \\ \dot{z} = x - y + 2z \end{cases} \quad 799. \begin{cases} \dot{x} = 3x - y + z, \\ \dot{y} = x + y + z, \\ \dot{z} = 4x - y + 4z \end{cases} \\ (\lambda_1 = 1, \lambda_2 = 2, \lambda_3 = 3). \quad (\lambda_1 = 1, \lambda_2 = 2, \lambda_3 = 5).$$

$$800. \begin{cases} \dot{x} = 4y - 2z - 3x, \\ \dot{y} = z + x, \\ \dot{z} = 6x - 6y + 5z \end{cases} \quad 801. \begin{cases} \dot{x} = x - y - z, \\ \dot{y} = x + y, \\ \dot{z} = 3x + z \end{cases} \\ (\lambda_1 = 1, \lambda_2 = 2, \lambda_3 = -1). \quad (\lambda_1 = 1, \lambda_{2,3} = 1 \pm 2i).$$

$$802. \begin{cases} \dot{x} = 2x + y, \\ \dot{y} = x + 3y - z, \\ \dot{z} = 2y + 3z - x \end{cases} \quad 803. \begin{cases} \dot{x} = 2x + 2z - y, \\ \dot{y} = x + 2z, \\ \dot{z} = y - 2x - z \end{cases} \\ (\lambda_1 = 2, \lambda_{2,3} = 3 \pm i). \quad (\lambda_1 = 1, \lambda_{2,3} = \pm i).$$

$$804. \begin{cases} \dot{x} = 4x - y - z, \\ \dot{y} = x + 2y - z, \\ \dot{z} = x - y + 2z \end{cases} \quad 805. \begin{cases} \dot{x} = 2x - y - z, \\ \dot{y} = 3x - 2y - 3z, \\ \dot{z} = 2z - x + y \end{cases} \\ (\lambda_1 = 2, \lambda_2 = \lambda_3 = 3). \quad (\lambda_1 = 0, \lambda_2 = \lambda_3 = 1).$$

$$806. \begin{cases} \dot{x} = y - 2x - 2z, \\ \dot{y} = x - 2y + 2z, \\ \dot{z} = 3x - 3y + 5z \end{cases} \quad 807. \begin{cases} \dot{x} = 3x - 2y - z, \\ \dot{y} = 3x - 4y - 3z, \\ \dot{z} = 2x - 4y \end{cases} \\ (\lambda_1 = 3, \lambda_2 = \lambda_3 = -1). \quad (\lambda_1 = \lambda_2 = 2, \lambda_3 = -5).$$

$$808. \begin{cases} \dot{x} = x - y + z, \\ \dot{y} = x + y - z, \\ \dot{z} = 2z - y \end{cases} \quad 809. \begin{cases} \dot{x} = y - 2z - x, \\ \dot{y} = 4x + y, \\ \dot{z} = 2x + y - z \end{cases} \\ (\lambda_1 = \lambda_2 = 1, \lambda_3 = 2). \quad (\lambda_1 = 1, \lambda_2 = \lambda_3 = -1).$$

$$810. \begin{cases} \dot{x} = 2x + y, \\ \dot{y} = 2y + 4z, \\ \dot{z} = x - z \end{cases} \quad 811. \begin{cases} \dot{x} = 2x - y - z, \\ \dot{y} = 2x - y - 2z, \\ \dot{z} = 2z - x + y \end{cases} \\ (\lambda_1 = \lambda_2 = 0, \lambda_3 = 3). \quad (\lambda_1 = \lambda_2 = \lambda_3 = 1).$$

$$812. \begin{cases} \dot{x} = 4x - y, \\ \dot{y} = 3x + y - z, \\ \dot{z} = x + z \end{cases} \quad (\lambda_1 = \lambda_2 = \lambda_3 = 2).$$

$$813. \begin{cases} \ddot{x} = 2x - 3y, \\ \ddot{y} = x - 2y. \end{cases} \quad 814. \begin{cases} \ddot{x} = 3x + 4y, \\ \ddot{y} = -x - y. \end{cases}$$

$$815. \begin{cases} \ddot{x} = 2y, \\ \ddot{y} = -2x. \end{cases} \quad 816. \begin{cases} \ddot{x} = 3x - y - z, \\ \ddot{y} = -x + 3y - z, \\ \ddot{z} = -x - y + 3z. \end{cases}$$

$$817. \begin{cases} 2\dot{x} - 5\dot{y} = 4y - x, \\ 3\dot{x} - 4\dot{y} = 2x - y. \end{cases} \quad 818. \begin{cases} \ddot{x} + \dot{x} + \dot{y} - 2y = 0, \\ \dot{x} - \dot{y} + x = 0. \end{cases}$$

$$819. \begin{cases} \ddot{x} - 2\ddot{y} + \dot{y} + x - 3y = 0, \\ 4\ddot{y} - 2\ddot{x} - \dot{x} - 2x + 5y = 0. \end{cases}$$

$$820. \begin{cases} \ddot{x} - x + 2\ddot{y} - 2y = 0, \\ \dot{x} - x + \dot{y} + y = 0. \end{cases}$$

$$821. \begin{cases} \ddot{x} - 2\dot{y} + 2x = 0, \\ 3\dot{x} + \ddot{y} - 8y = 0. \end{cases} \quad 822. \begin{cases} \ddot{x} + 3\ddot{y} - x = 0, \\ \dot{x} + 3\dot{y} - 2y = 0. \end{cases}$$

$$823. \begin{cases} \ddot{x} + 5\dot{x} + 2\dot{y} + y = 0, \\ 3\ddot{x} + 5x + \dot{y} + 3y = 0. \end{cases}$$

$$826. \begin{cases} \dot{x} = y + 2e^t, \\ \dot{y} = x + t^2. \end{cases}$$

$$827. \begin{cases} \dot{x} = y - 5 \cos t, \\ \dot{y} = 2x + y. \end{cases}$$

$$824. \begin{cases} \ddot{x} + 4\dot{x} - 2x - 2\dot{y} - y = 0, \\ \ddot{x} - 4\dot{x} - \ddot{y} + 2\dot{y} + 2y = 0. \end{cases}$$

$$828. \begin{cases} \dot{x} = 3x + 2y + 4e^{5t}, \\ \dot{y} = x + 2y. \end{cases}$$

$$829. \begin{cases} \dot{x} = 2x - 4y + 4e^{-2t}, \\ \dot{y} = 2x - 2y. \end{cases}$$

$$825. \begin{cases} 2\ddot{x} + 2\dot{x} + x + 3\ddot{y} + \dot{y} + y = 0, \\ \ddot{x} + 4\dot{x} - x + 3\ddot{y} + 2\dot{y} - y = 0. \end{cases}$$

$$830. \begin{cases} \dot{x} = 4x + y - e^{2t}, \\ \dot{y} = y - 2x. \end{cases}$$

$$831. \begin{cases} \dot{x} = 2y - x + 1, \\ \dot{y} = 3y - 2x. \end{cases}$$

$$834. \begin{cases} \dot{x} = x + 2y, \\ \dot{y} = x - 5 \sin t. \end{cases} \quad 835. \begin{cases} \dot{x} = 2x - 4y, \\ \dot{y} = x - 3y + 3e^t. \end{cases} \quad \begin{cases} \dot{x} = 5x - 3y + 2e^{3t}, \\ \dot{y} = x + y + 5e^{-t}. \end{cases}$$

$$833. \begin{cases} \dot{x} = 2x + y + e^t, \\ \dot{y} = -2x + 2t. \end{cases}$$

$$836. \begin{cases} \dot{x} = 2x - y, \\ \dot{y} = y - 2x + 18t. \end{cases}$$

$$837. \begin{cases} \dot{x} = x + 2y + 16te^t, \\ \dot{y} = 2x - 2y. \end{cases}$$

$$838. \begin{cases} \dot{x} = 2x + 4y - 8, \\ \dot{y} = 3x + 6y. \end{cases}$$

$$839. \begin{cases} \dot{x} = 2x - 3y, \\ \dot{y} = x - 2y + 2 \sin t. \end{cases}$$

$$840. \begin{cases} \dot{x} = x - y + 2 \sin t, \\ \dot{y} = 2x - y. \end{cases}$$

$$841. \begin{cases} \dot{x} = 2x - y, \\ \dot{y} = x + 2e^t. \end{cases}$$

$$842. \begin{cases} \dot{x} = 4x - 3y + \sin t, \\ \dot{y} = 2x - y - 2 \cos t. \end{cases}$$

$$843. \begin{cases} \dot{x} = 2x + y + 2e^t, \\ \dot{y} = x + 2y - 3e^{4t}. \end{cases}$$

$$844. \begin{cases} \dot{x} = x - y + 8t, \\ \dot{y} = 5x - y. \end{cases}$$

$$845. \begin{cases} \dot{x} = 2x - y, \\ \dot{y} = 2y - x - 5e^t \sin t. \end{cases}$$

$$846. \begin{cases} \dot{x} = y + \operatorname{tg}^2 t - 1, \\ \dot{y} = -x + \operatorname{tg} t. \end{cases} \quad 847. \begin{cases} \dot{x} = 2y - x, \\ \dot{y} = 4y - 3x + \frac{e^{3t}}{e^{2t} + 1}. \end{cases}$$

$$848. \begin{cases} \dot{x} = -4x - 2y + \frac{2}{e^t - 1}, \\ \dot{y} = 6x + 3y - \frac{3}{e^t - 1}. \end{cases}$$

$$851. \dot{x} = Ax, \quad A = \begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}.$$

$$852. \dot{x} = Ax, \quad A = \begin{pmatrix} 1 & 1 \\ 2 & 0 \end{pmatrix}.$$

$$849. \begin{cases} \dot{x} = x - y + \frac{1}{\cos t}, \\ \dot{y} = 2x - y. \end{cases} \quad 850. \begin{cases} \dot{x} = 3x - 2y, \\ \dot{y} = 2x - y + 15e^t \sqrt{t}. \end{cases}$$

$$853. \dot{x} = Ax, \quad A = \begin{pmatrix} 1 & -2 \\ 2 & -3 \end{pmatrix}.$$

$$854. \dot{x} = Ax, \quad A = \begin{pmatrix} 3 & -2 \\ 4 & -1 \end{pmatrix}.$$

$$855. \dot{x} = Ax, \quad A = \begin{pmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \\ 3 & -1 & -2 \end{pmatrix}.$$

$$856. \dot{x} = Ax, \quad A = \begin{pmatrix} 1 & -2 & 2 \\ 1 & 4 & -2 \\ 1 & 5 & -3 \end{pmatrix}.$$

$$857. \dot{x} = Ax, \quad A = \begin{pmatrix} -1 & -2 & 2 \\ -2 & -1 & 2 \\ -3 & -2 & 3 \end{pmatrix}.$$

$$858. \dot{x} = Ax, \quad A = \begin{pmatrix} -3 & 2 & 2 \\ -3 & -1 & 1 \\ -1 & 2 & 0 \end{pmatrix}.$$

$$859. \dot{x} = Ax, \quad A = \begin{pmatrix} 3 & -3 & 1 \\ 3 & -2 & 2 \\ -1 & 2 & 0 \end{pmatrix}.$$

$$860. \dot{x} = Ax, \quad A = \begin{pmatrix} 2 & 1 & -1 \\ -1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}.$$

$$861. \dot{x} = Ax, \quad A = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 2 & 2 & 1 \end{pmatrix}.$$

$$862. \dot{x} = Ax, \quad A = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ -1 & 0 & 1 \end{pmatrix}.$$

$$863. \dot{x} = Ax, \quad A = \begin{pmatrix} -2 & 1 & 2 \\ -1 & 0 & 2 \\ -2 & 0 & 3 \end{pmatrix}.$$

$$864. \dot{x} = Ax, \quad A = \begin{pmatrix} 0 & 1 & -1 \\ 1 & 0 & -1 \\ 2 & 2 & -3 \end{pmatrix}.$$

$$865. \dot{x} = Ax, \quad A = \begin{pmatrix} 4 & 2 & -2 \\ 1 & 3 & -1 \\ 3 & 3 & -1 \end{pmatrix}.$$

$$866. \dot{x} = Ax, \quad A = \begin{pmatrix} 2 & 0 & -1 \\ 1 & -1 & 0 \\ 3 & -1 & -1 \end{pmatrix}$$

$$867. A = \begin{pmatrix} 3 & 0 \\ 0 & -2 \end{pmatrix}. \quad 868. A = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}.$$

$$869. A = \begin{pmatrix} 2 & 1 \\ 0 & 2 \end{pmatrix}. \quad 870. A = \begin{pmatrix} 3 & -1 \\ 2 & 0 \end{pmatrix}.$$

$$871. A = \begin{pmatrix} -2 & -4 \\ 1 & 2 \end{pmatrix}. \quad 872. A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 2 \end{pmatrix}.$$

$$873. A = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{pmatrix}.$$

5. Hệ phương trình phi tuyến: Bài tập:1141-1160

$$1141. y' = \frac{x}{z}, \quad z' = -\frac{x}{y}.$$

$$1142. y' = \frac{y^2}{z-x}, \quad z' = y+1.$$

$$1143. y' = \frac{z}{x}, \quad z' = \frac{z(y+2z-1)}{x(y-1)}.$$

$$1144. y' = y^2 z, \quad z' = \frac{z}{x} - yz^2.$$

$$1145. 2zy' = y^2 - z^2 + 1, \quad z' = z + y.$$

$$1146. \frac{dx}{2y-z} = \frac{dy}{y} = \frac{dz}{z}.$$

$$1147. \frac{dx}{y} = \frac{dy}{x} = \frac{dz}{z}.$$

$$1148. \frac{dx}{y+z} = \frac{dy}{x+z} = \frac{dz}{x+y}.$$

$$1149. \frac{dx}{y-x} = \frac{dy}{x+y+z} = \frac{dz}{x-y}.$$

$$1150. \frac{dx}{z} = \frac{dy}{u} = \frac{dz}{x} = \frac{du}{y}.$$

$$1151. \frac{dx}{y-u} = \frac{dy}{z-x} = \frac{dz}{u-y} = \frac{du}{x-z}.$$

$$1152. \frac{dx}{z} = \frac{dy}{xz} = \frac{dz}{y}.$$

$$1153. \frac{dx}{z^2-y^2} = \frac{dy}{z} = -\frac{dz}{y}.$$

$$1154. \frac{dx}{x} = \frac{dy}{y} = \frac{dz}{xy+z}.$$

$$1155. \frac{dx}{xz} = \frac{dy}{yz} = \frac{dz}{xy\sqrt{z^2+1}}.$$

$$1156. \frac{dx}{x+y^2+z^2} = \frac{dy}{y} = \frac{dz}{z}.$$

$$1157. \frac{dx}{x(y+z)} = \frac{dy}{z(z-y)} = \frac{dz}{y(y-z)}.$$

$$1158. -\frac{dx}{x^2} = \frac{dy}{xy-2z^2} = \frac{dz}{xz}.$$

$$1159. \frac{dx}{x(z-y)} = \frac{dy}{y(y-x)} = \frac{dz}{y^2-xz}.$$

$$1160. \frac{dx}{x(y^2-z^2)} = -\frac{dy}{y(z^2+x^2)} = \frac{dz}{z(x^2+y^2)}.$$