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1. **(1 pt) Library/274/Lin1stord/prob7.pg**
Solve the following initial value problem:

$$\frac{dy}{dt} + 0.5ty = 5t$$

with $y(0) = 6$.
$y =$ ______________.

---

2. **(1 pt) Library/274/Lin1stord/prob2.pg**
Find the particular solution of the differential equation

$$\frac{dy}{dx} + y\cos(x) = 4\cos(x)$$

satisfying the initial condition $y(0) = 6$.
Answer: $y(x)$= ______________.

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3. **(1 pt) Library/274/Exact/prob5.pg**
The differential equation

$$y + 2y^5 = \left(y^4 + 4x\right) y'$$

can be written in differential form:

$$M(x,y)\,dx + N(x,y)\,dy = 0$$

where
$M(x,y) =$ __________ , and $N(x,y) =$ __________.

The term $M(x,y)\,dx + N(x,y)\,dy$ becomes an exact differential if the left hand side above is divided by y^5. Integrating that new equation, the solution of the differential equation is ______________ $= C$.

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4. **(1 pt) Library/274/Exact/prob3.pg**
Use the "mixed partials" check to see if the following differential equation is exact.

If it is exact find a function $F(x,y)$ whose differential, $dF(x,y)$ gives the differential equation. That is, level curves $F(x,y) = C$ are solutions to the differential equation:

$$\frac{dy}{dx} = \frac{-4x^3 - 4y}{4x - y^4}$$

First rewrite as

$$M(x,y)\,dx + N(x,y)\,dy = 0$$

where $M(x,y) =$ __________ ,
and $N(x,y) =$ __________.

If the equation is not exact, enter *not exact,* otherwise enter in $F(x,y)$ as the solution of the differential equation here ______________ $= C$.

---

5. **(1 pt) Library/274/Exact/prob1.pg**
Use the "mixed partials" check to see if the following differential equation is exact.
If it is exact find a function F(x,y) whose differential, $dF(x,y)$ is the left hand side of the differential equation. That is, level curves $F(x,y) = C$ are solutions to the differential equation:

$$(4x^4 + 4y)dx + (1x - 1y^1)dy = 0$$

First:
$M_y(x,y) =$ __________ , and $N_x(x,y) =$ __________.

If the equation is not exact, enter *not exact,* otherwise enter in $F(x,y)$ here __________

---

6. **(1 pt) Library/Rochester/setDiffEQ3Separable/ns7_4_13a.pg**
Find an equation of the curve that satisfies

$$\frac{dy}{dx} = 78yx^{12}$$

and whose y-intercept is 6.
$y(x) =$ ______________.

---

7. **(1 pt) Library/Rochester/setDiffEQ3Separable/ur_de_3_3.pg**
The differential equation

$$64\,\frac{dy}{dx} = (25 - x^2)^{-1/2}\exp(-8y)$$

has an implicit general solution of the form $F(x,y) = K$.
In fact, because the differential equation is separable, we can define the solution curve implicitly by a function in the form

$$F(x,y) = G(x) + H(y) = K.$$

Find such a solution and then give the related functions requested.
$F(x,y) = G(x) + H(y) =$

______________________________ .

---

8. **(1 pt) Library/Rochester/setDiffEQ3Separable/ns7_4_3a.pg**
Solve the seperable differential equation

$$5yy' = x.$$

Use the following initial condition: $y(5) = 10$.
Express x^2 in terms of y.
$x^2 =$ ______________ (function of y).

9. **(1 pt) Library/Rochester/setDiffEQ3Separable/ur_de_3_16.pg**
Solve the separable differential equation

$$\frac{dx}{dt} = x^2 + \frac{1}{16},$$

and find the particular solution satisfying the initial condition

$$x(0) = 6.$$

$x(t) =$ ____________________.

10. **(1 pt) Library/Rochester/setDiffEQ3Separable/ns7_4_8.pg**
Solve the differential equation

$$(y^{17}x)\frac{dy}{dx} = 1 + x.$$

Use the initial condition $y(1) = 3$.
Express y^{18} in terms of x.
$y^{18} =$ ____________________.

11. **(1 pt) Library/Rochester/setDiffEQ3Separable/ns7_4_10.pg**
Solve the separable differential equation

$$11x - 4y\sqrt{x^2+1}\,\frac{dy}{dx} = 0.$$

Subject to the initial condition: $y(0) = 6$.
$y =$ ____________________.

SOLUTION:

SOLUTION: (Instructor solution preview: show the student solution after due date.)

Solution:
First separate the variables:
$11x = 4y\sqrt{x^2+1}\,\frac{dy}{dx}$
$\frac{11x}{\sqrt{x^2+1}}dx = 4ydy$
Now integrate both sides:
$\int \frac{11x}{\sqrt{x^2+1}}\,dx = \int 4ydy$
On the left hand side, make the substitution $u = x^2+1$, $du = 2xdx$, $\frac{1}{2}du = xdx$, then
$\int \frac{11x}{\sqrt{x^2+1}}\,dx = \int \frac{5.5}{\sqrt{u}}\,du = 5.5\frac{\sqrt{u}}{1/2} + C$
$= 11\sqrt{u} + C = 11\sqrt{x^2+1} + C.$
Thus we have
$11\sqrt{x^2+1} + C = 2y^2$
$y^2 = \frac{11}{2}\sqrt{x^2+1} + \frac{C}{2}$
$y^2 = \frac{11}{2}\sqrt{x^2+1} + K.$
$y = \pm\sqrt{\frac{11}{2}\sqrt{x^2+1} + K}.$
We need $y(0) = 6$, so we have to use +, and we find K from
$6 = \sqrt{\frac{11}{2}\sqrt{0^2+1} + K}$:
$36 = \frac{11}{2} + K$
$K = 36 - \frac{11}{2} = 30.5.$

Therefore the solution is $y = \sqrt{\frac{11}{2}\sqrt{x^2+1} + 30.5}.$

12. **(1 pt) Library/Rochester/setDiffEQ3Separable/ur_de_3_15.pg**
Solve the separable differential equation

$$\frac{dy}{dx} = \frac{-0.4}{\cos(y)},$$

and find the particular solution satisfying the initial condition

$$y(0) = \frac{\pi}{2}.$$

$y(x) =$ ____________________.

13. **(1 pt) Library/Rochester/setDiffEQ3Separable/jas7_4_5b.pg**
Solve the separable differential equation for u

$$\frac{du}{dt} = e^{5u+9t}.$$

Use the following initial condition: $u(0) = -5$.
$u =$ ____________________.

14. **(1 pt) Library/UMN/calculusStewartCCC/s_7_3_prob01.pg**
Find the solution of the differential equation $\frac{dy}{dx} = y^2 + 4$ that satisfies the initial condition $y(2) = 0$.

Answer: $y(x) =$ ______________

15. **(1 pt) Library/FortLewis/DiffEq/1-First-order/04-Linear-integrating-factor/KJ-2-2-37.pg**

(1) Find the solution to the initial value problem

$$\frac{y' - e^{-t} + 5}{y} = -5, \quad y(0) = -2.$$

____

(2) Discuss the behavior of the solution $y(t)$ as t becomes large. Does $\lim_{t\to\infty} y(t)$ exist? If the limit exists, enter its value. If the limit does not exist, enter *DNE* .

$\lim_{t\to\infty} y(t) =$ __________

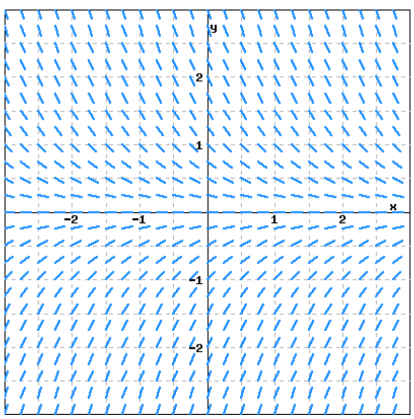
16. **(1 pt) Library/FortLewis/DiffEq/1-First-order/02-Slope-fields/KJ-1-3-14.pg**

Consider the slope field shown.

(a) For the solution that satisfies $y(0) = 0$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____

(b) For the solution that satisfies $y(0) = 1$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____

(c) For the solution that satisfies $y(0) = -1$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____



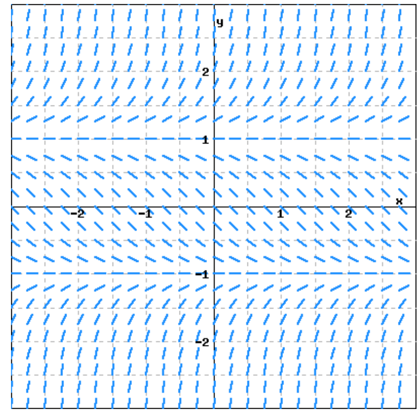
17. **(1 pt) Library/FortLewis/DiffEq/1-First-order/02-Slope-fields/KJ-1-3-16.pg**

Consider the slope field shown.

(a) For the solution that satisfies $y(0) = 0$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____

(b) For the solution that satisfies $y(0) = 1$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____

(c) For the solution that satisfies $y(0) = -1$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____



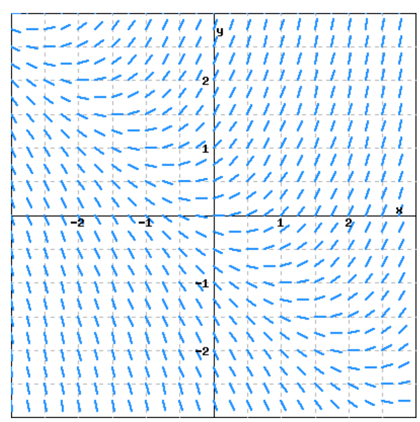
18. **(1 pt) Library/FortLewis/DiffEq/1-First-order/02-Slope-fields/KJ-1-3-18.pg**

Consider the slope field shown.

(a) For the solution that satisfies $y(0) = 0$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____

(b) For the solution that satisfies $y(0) = 1$, sketch the solution curve and estimate the following:
$y(0.5) \approx$ _____ and $y(-1) \approx$ _____

(c) For the solution that satisfies $y(0) = -1$, sketch the solution curve and estimate the following:
$y(1) \approx$ _____ and $y(-1) \approx$ _____



19. **(1 pt) Library/FortLewis/DiffEq/1-First-order/08-Existence-uniqueness/KJ-2-1-06.pg**

Put the differential equation $4ty + e^t y' = \frac{y}{t^2+16}$ into the form $y' + p(t)y = g(t)$ and find $p(t)$ and $g(t)$.

$p(t) =$ ______________

$g(t) =$ ______________

Is the differential equation $4ty + e^t y' = \frac{y}{t^2+16}$ linear and homogeneous, linear and nonhomogeneous, or nonlinear?

Answer: ?

20. **(1 pt) Library/FortLewis/DiffEq/1-First-order/08-Existence-uniqueness/KJ-2-1-16.pg**
Consider the initial value problem

$$2ty' = 4y, \quad y(-2) = -4.$$

(1) Find the value of the constant C and the exponent r so that $y = Ct^r$ is the solution of this initial value problem.
$y =$ ______

(2) Determine the largest interval of the form $a < t < b$ on which the existence and uniqueness theorem for first order linear differential equations guarantees the existence of a unique solution.
______

(3) What is the actual interval of existence for the solution (from part a)?
______

21. **(1 pt) Library/FortLewis/DiffEq/1-First-order/01-Integrals-as-solutions/Lebl-1-1-09.pg**
A spaceship is traveling directly away from earth with speed $6t^2 + 1$ km/s. At time $t = 0$ is is 1500 km from earth. How far is it from earth one minute after time $t = 0$? Include units in your answer.

Distance = ______

22. **(1 pt) Library/FortLewis/DiffEq/1-First-order/01-Integrals-as-solutions/Lebl-1-1-08.pg**
Solve $y'' = \sin(x)$ if $y(0) = 0$ and $y'(0) = 8$.

$y(x) =$ ______

23. **(1 pt) Library/FortLewis/DiffEq/1-First-order/03-Separable/Lebl-1-3-01.pg**
Solve the differential equation $\frac{dy}{dx} = \frac{x}{4y}$.

(1) Find an implicit solution and put your answer in the following form:
______ = constant.

(2) Find the equation of the solution through the point $(x,y) = (-2,1)$.
______

(3) Find the equation of the solution through the point $(x,y) = (0,-4)$. Your answer should be of the form $y = f(x)$.
______

24. **(1 pt) Library/maCalcDB/setDiffEQ3Separable/ns7_4_10.pg**
Solve the separable differential equation

$$10x - 3y\sqrt{x^2+1}\frac{dy}{dx} = 0.$$

Subject to the initial condition: $y(0) = 10$.
$y =$ ______.

25. **(1 pt) Library/Michigan/Chap11Sec4/Q43.pg**
Find the general solution to the differential equation modeling how a person learns:

$$\frac{dy}{dt} = 100 - y.$$

Then find the particular solutions with the following initial conditions:
$y(0) = 5 : y =$ ______
$y(0) = 125 : y =$ ______
Plot the slope field of this differential equation and sketch the solutions with $y(0) = 5$ and $y(0) = 125$.

Which of these two particular solutions could represent how a person learns?

- A. $y(0) = 5$
- B. $y(0) = 125$
- C. either of these
- D. none of the above

SOLUTION:

SOLUTION: (Instructor solution preview: show the student solution after due date.)

SOLUTION
Separating variables and integrating gives

$$\int \frac{1}{100-y}dy = \int dt,$$

so that

$$-\ln|100-y| = t + C$$

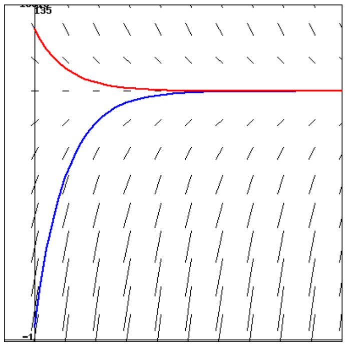
or

$$y(t) = 100 - Ae^{-t}.$$

Thus with the initial condition $y(0) = 5$ we must have $5 = 100 - A$, or $A = 100 - 5 = 95$. Similarly, if $y(0) = 125$, $A = 100 - 125 = -$. Thus the two particular solutions are

$$y = 100 - 95e^{-t} \quad \text{and} \quad y = 100 + 25e^{-t}.$$

The slope field and graphs of the two solutions (that with $y(0) = 5$ in blue and the other in red) is shown below.



(Click on the graph for a larger version.)

Because the second solution would require a person to start off knowing more than 100 percent of the information, the first is that which could represent how a person learns.