AP Physics C
Math Problems

Name ______________________________

1. The position of a particle as a function of time is given by the equation $x(t)=6t^3- 2t^2 -4t-3$.
   a. Derive an expression for the velocity of the particle.

$v(t) = 18t^2 - 4t - 4$

   b. At what time is the particle's velocity at a minimum?

$t = 1/9$

2. The velocity for a particle as a function of time is given by the equation $v(t)=3x^2 – 4x +5$.
   a. Derive an expression for the particle's acceleration as a function of time.

$a(t) = 6t - 4$

   b. At what time is the particle's acceleration equal to 0?

$t = 2/3$

   c. In which direction (positive or negative) is the particle heading in at this time? (show work)

positive

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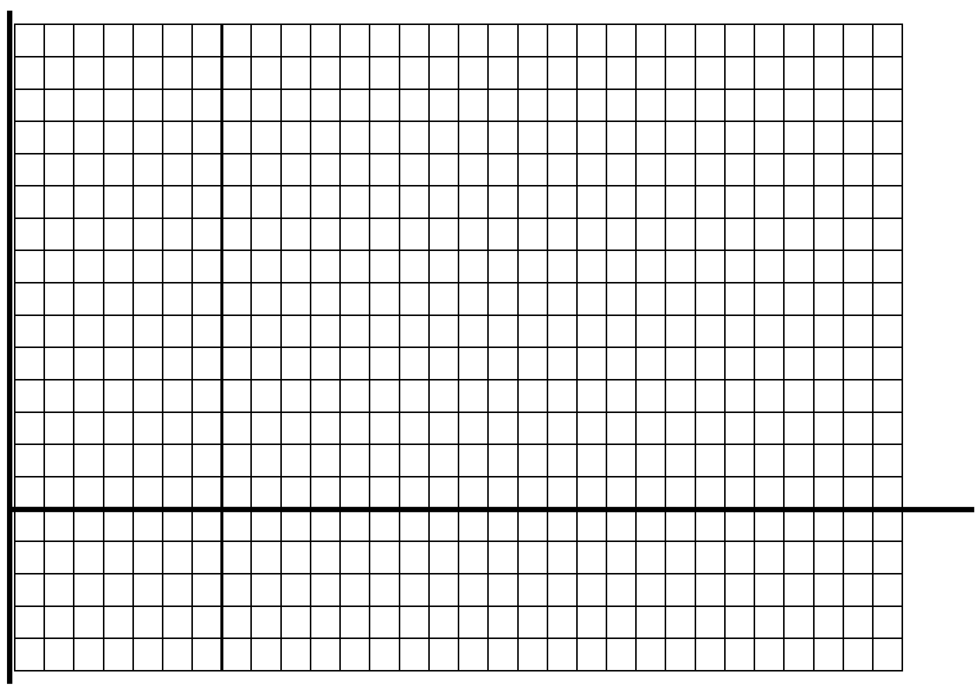
d. Derive an expression for the particle's position as a function of time. The particle starts at the origin.

$x(t) = t^3 - 2t^2 + 5t$

3. Graph the following equation: $v(t)= t^3-6t^2+6t+2$. Determine the particle's acceleration at t=2 s using both a tangent line and by evaluating the derivative. Also come up with an expression for its position as a function of time if the particle starts at x=3 m.



$a(2) = -6$

$x(t) = 1/4t^4 - 2t^3 + 3t^2 + 2t + 3$

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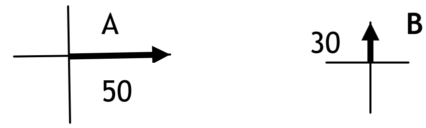
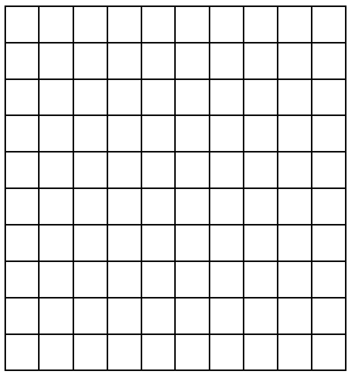
4. For the vectors **A** and **B** pictured at right, find resultant



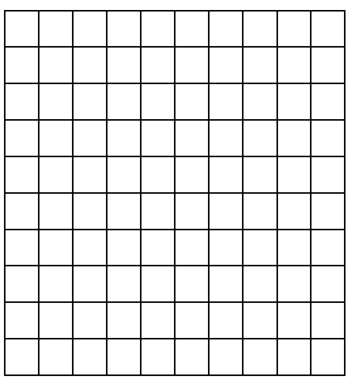
<u>Graphically</u> <u>Mathematically in **i**, **j** Format</u>

(a) **A-B**



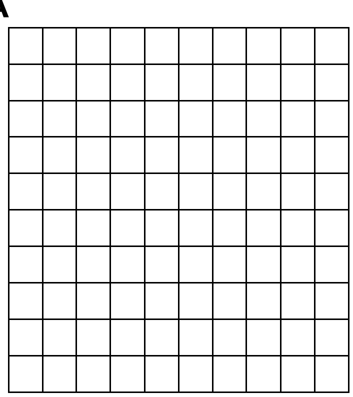
A – **B** = 50**i** – 30**j**

(b) **A-3B**



A – 3**B** = 50**i** – 90**j**

(c) **B-2A**



B – 2**A** = -100**i** + 30**j**

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5. a. A vector **A** is given by **A**=3**i**-4**j**. Determine the magnitude of the vector and the angle it makes with the horizontal.

A – **B** = 50**i** – 30**j**

b. Vector **B** is given by **B**=5**i**+12**j**. Find **A**+**B** and **A-B** in terms of vector components and in terms of magnitude and direction of the resultant.

A + **B** = 8**i** + 8**j**

A – **B** = **-2i** – 16**j**

A + **B** = 11.3 @ +45°

A – **B** = 16.1 @ 262.9°

6. Calculate the derivative of the following function: $x(t) = 3\cos\left(\frac{2\pi}{3}t - \frac{\pi}{4}\right)$

$v(t) = -2\pi\sin(\frac{2\pi}{3}t - \frac{\pi}{4})$

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Directions: Use the following table to complete the integrations below. Show all of your work in order to receive full credit. If you have any questions be sure to ask.

Given	Rewrite	Integrate	Simplify
$\int \frac{2}{\sqrt{x}}\,dx$	$2\int x^{-1/2}dx$	$2\left(\frac{x^{1/2}}{1/2}\right)+C$	$4x^{1/2}+C$
$\int \left(t^2+1\right)^2 dt$	$\int \left(t^4+2t^2+1\right)dt$	$\frac{t^5}{5}+2\left(\frac{t^3}{3}\right)+t+C$	$\frac{1}{5}t^5+\frac{2}{3}t^3+t+C$
$\int \frac{x^3+3}{x^2}\,dx$	$\int \left(x+3x^{-2}\right)dx$	$\frac{x^2}{2}+3\left(\frac{x^{-1}}{-1}\right)+C$	$\frac{1}{2}x^2-\frac{3}{x}+C$
$\int \sqrt[3]{x}\left(x-4\right)dx$	$\int \left(x^{4/3}-4x^{1/3}\right)dx$	$\frac{x^{7/3}}{7/3}-4\left(\frac{x^{4/3}}{4/3}\right)+C$	$\frac{3}{7}x^{4/3}\left(x-7\right)+C$

7. $\int \sqrt[3]{x}\,dx$

8. $\int \frac{1}{x^2}\,dx$

9. $\int \frac{1}{x\sqrt{x}}\,dx$

10. $\int x\left(x^2+3\right)dx$

11. $\int \frac{1}{2x^3}\,dx$

12. $\int \frac{1}{\left(2x\right)^3}\,dx$

Evaluate the integral and check your result by differentiation.

13. $\int \left(x^3+2\right)dx$

14. $\int \left(x^2-2x+3\right)dx$

15. $\int \left(x^{3/2}+2x+1\right)dx$

16. $\int \left(\sqrt{x}+\frac{1}{2\sqrt{x}}\right)dx$