

8. If the line normal to the graph of f at the point $(1, 2)$ passes through the point $(-1, 1)$, then which of the following gives the value of $f'(1)$?

- a) -2 b) 2 c) -12 d) 12 e) 3

$$M = \frac{2-1}{1-(-1)} = \frac{1}{2}$$

$$M_{TAN} = -2 = -\frac{1}{M} = -f'(1)$$

9. $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x}{\sin^2 x + \cos^2 x} = \lim_{x \rightarrow \frac{\pi}{4}} \sin x$

- a) $\frac{-1}{\sqrt{2}}$
 b) 0
 c) $\frac{1}{\sqrt{2}}$
 d) $\frac{\sqrt{3}}{2}$
 e) The limit does not exist

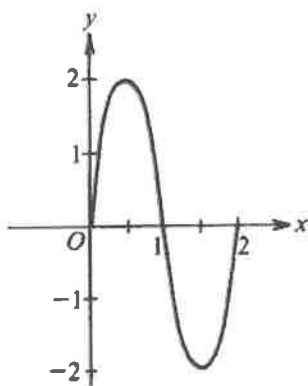
10. A particle moves along a straight line with equation $s(t) = t^3 - t^2$ of motion. Find the value of t at which the acceleration is zero.

- a) $-\frac{2}{3}$ b) $-\frac{1}{3}$ c) $\frac{2}{3}$ d) $\frac{1}{3}$ e) $\frac{1}{2}$

$$v = 3t^2 - 2t$$

$$a = 6t - 2 = 0$$

11.



$A = 2$
 $P = \frac{2\pi}{B} = 2 \rightarrow B = \pi$

The figure above shows the graph of a sine function for one complete period. Which of the following is an equation for the graph?

(A) $y = 2 \sin\left(\frac{\pi}{2}x\right)$

~~(B)~~ $y = \sin(\pi x)$

(C) $y = 2 \sin(2x)$

(D) $y = 2 \sin(\pi x)$

~~(E)~~ $y = \sin(2x)$

12. Let $f(x) = x - \frac{1}{x}$. Find $f''(x)$.

a) $1 + \frac{1}{x^2}$

$f'(x) = 1 + x^{-2}$

b) $1 - \frac{1}{x^2}$

$f''(x) = -2x^{-3}$

c) $\frac{2}{x^3}$

d) $-\frac{2}{x^3}$

e) Does not exist

Honors PreCalc 21-22
Fall Final – Part II (40 minutes)
Dr. Quattrin
CALCULATOR ALLOWED

Name Sauronkey

Score _____

1. Solve exactly for $x \in [0^\circ, 180^\circ)$: $\sin^2 2x - 2\sin x \cos x = 2$

$$\sin^2 2x - \sin 2x - 2 = 0$$

$$(\sin 2x - 2)(\sin 2x + 1)$$

$$\sin 2x = 2$$

NO SOLUTION

$$\sin 2x = -1$$

$$2x = \frac{3\pi}{2} \quad 270^\circ \pm 360^\circ n$$

$$x = 135^\circ \pm 180^\circ n$$

$$x \in \{135^\circ\}$$

2. The position of a particle is described by $x(t) = t^3 - 4t^2 + 5t - 20$.:

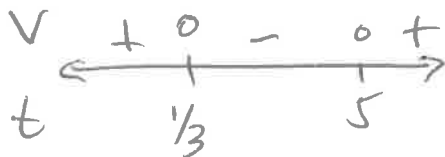
a) When is the particle at rest?

$$v(t) = 3t^2 - 8t + 5$$

$$(3t - 1)(t - 5) = 0$$

$$t = \frac{1}{3}, 5$$

b) When is the particle moving right?



$$t \in (-\infty, \frac{1}{3}] \cup [5, \infty)$$

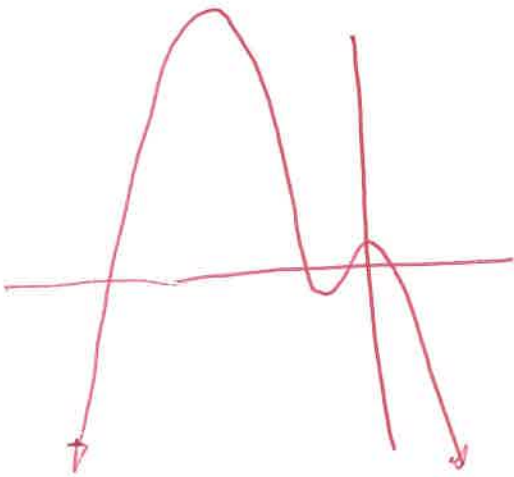
c) What is the acceleration at $t = 4$?

$$-a(t) = 6t - 8$$

$$a(4) = 16$$

3. Given $f(x) = -\frac{1}{2}x^4 - 9x^3 + 4x^2 + 8x - 3$, use your graphing calculator to:

a) Sketch a complete graph. State the window used.



$$x \in [-20, 10]$$
$$y \in [-100, 7000]$$

b) Find the zeros. $(-18.387, 0)$

$$(-.935, 0)$$

$$(.364, 0)$$

$$(.958, 0)$$

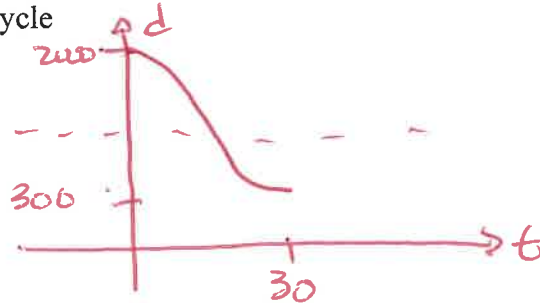
c) Find all the extreme points. $(-.421, -5.002)$

$$(.690, 1.354)$$

$$(-13.769, 6167.492)$$

6. A spaceship is in an elliptical orbit around Earth. At time $t = 0$, it is at its apogee (highest point) which is $d = 2000$ km. It reaches its perigee (lowest point) of $d = 300$ km 30 minutes later.

- (a) Assuming distance d varies sinusoidally with time t , sketch a graph of one cycle



- (b) Find an equation for your sketch.

$$d = 1150 + 850 \cos\left(\frac{\pi}{30} t\right)$$

- (c) If the ship is only in communication range when it is below 500 km, for how many minutes is the ship out of range (during its primary cycle)?

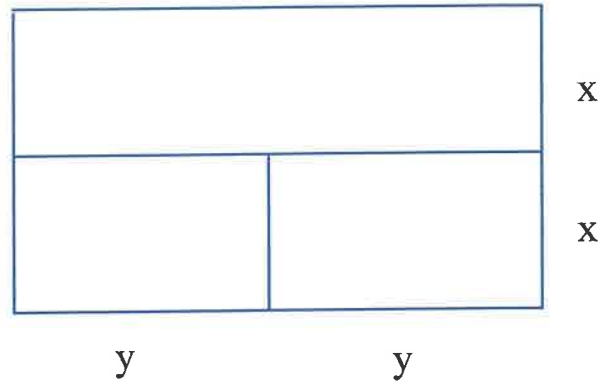
$$500 = 1150 + 850 \cos\left(\frac{\pi}{30} t\right)$$

$$-0.765 = \cos\left(\frac{\pi}{30} t\right)$$

$$\pm 2.441 \pm 2\pi n = \frac{\pi}{30} t$$

$$\pm 23.313 \pm 60n = t$$

OUT OF RANGE FOR 46.827 MINUTES



5. A farmer has 10,000-square-foot field which has been subdivided into two equal pens and one of those pens has been further subdivided into two equal fields as shown above. He wants to minimize the amount of fencing to enclose the pens.

- a) State the equation needed to minimize the amount of fencing to be used.

$$F = 6y + 5x$$

- b) State the secondary equation needed to eliminate the extra variable.

$$2x(2y) = 10000 \rightarrow xy = 2500$$

- c) Eliminate the extra variable in the equation needed to minimize the amount of fencing.

$$F = 6\left(\frac{2500}{x}\right) + 5x$$

- d) Use your calculator to find the minimum amount of fencing needed to enclose the field.

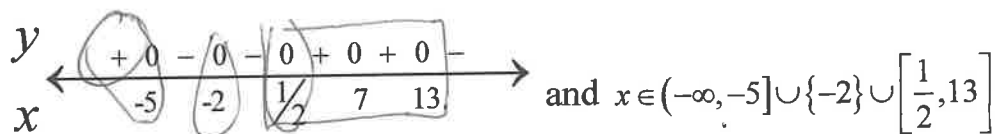
$$x = 55.678 \rightarrow F = 556.776'$$

Honors PreCalc 21 -22
Fall Final – Part III (25 minutes)
Dr. Quattrin
NO CALCULATOR ALLOWED

Name Southern Key

Score _____

6. Find an inequality that has this sign pattern and solution:



$$-(x+5)(x+2)^2(2x-1)(x-7)^2(x-13) \geq 0$$

7. Prove $\cot A + \tan A = 2 \csc 2A$

$$\frac{\cos A}{\sin A} + \frac{\sin A}{\cos A} = \frac{2}{\sin 2A}$$

$$\frac{\cos^2 A + \sin^2 A}{\sin A \cos A} = \frac{2}{2 \sin A \cos A}$$
$$= \frac{1}{\sin A \cos A}$$

8. Let $f(x) = 11x^9 - 19x^3 + 15x + \pi + \sqrt[20]{x^7} + \frac{5}{x^{16}}$. Find $f'(x)$.

$$f'(x) = 99x^8 - 57x^2 + 15 + \frac{7}{20}x^{-17/20} - 80x^{-17}$$

9. Evaluate the following limits:

a) $\lim_{x \rightarrow 0} \frac{2x(3 + \sqrt{x+9})}{(3 - \sqrt{x+9})(3 + \sqrt{x+9})}$

$$= \lim_{x \rightarrow 0} \frac{2x(3 + \sqrt{x+9})}{9 - (x-9)} = \lim_{x \rightarrow 0} \frac{2(3 + \sqrt{x+9})}{20} = 12$$

b) $\lim_{t \rightarrow 0} \frac{t^3 + 2t}{\sqrt{t^8 + 4t^4}} = \frac{0}{0}$

$$= \lim_{t \rightarrow 0} \frac{t(t^2 + 2)}{t^2(t^4 + 4)^{1/2}} = \frac{2}{0} = \text{DNE}$$