

Standard 2.01 - key

① A) $f(x) = \frac{\sqrt{x+11}}{x^2+8x}$

$x+11 > 0$ $x^2+8x \neq 0$
 $x(x+8) \neq 0$
 $x > -11$ $x \neq 0$ $x \neq -8$

$(-11, -8) \cup (-8, 0) \cup (0, \infty)$

B) $f(x) = \frac{x^3-1}{\sqrt{2x-3}}$

$2x-3 > 0$
 $2x > 3$
 $x > 3/2$

$(3/2, \infty)$

② A) $y = 600x$ if $x \leq 20$
 $y = x(600 - 15(x-20))$
 x = # of trees
 y = # of oranges

B) $x = 20$
 graph + find intersection

③ A) exponential ($y = e^x$)
 D: $\{x | x \in \mathbb{R}\}$ $(-\infty, \infty)$
 R: $\{y | y > 0\}$ $(0, \infty)$

B) Absolute value ($y = |x|$)
 D: $\{x | x \in \mathbb{R}\}$ $(-\infty, \infty)$
 R: $\{y | y \geq 0\}$ $[0, \infty)$

④ A) YES \Rightarrow passes vertical line test

B) NO \Rightarrow going to be side facing parabola which will fail V.L.T

C) YES \Rightarrow sqrt function passes V.L.T

⑤ A) $f(x) = -x^3 + 10x^2 - 28x + 19$
 max: (4, 5) (4, 5)
 min: (2, -5)
 inc: (2, 4.5) dec: $(-\infty, 2) \cup (4.5, \infty)$
 D: $(-\infty, \infty)$ R: $(-\infty, \infty)$

B) $f(x) = x^4 - 3x^2 - 2x + 3$
 max: (-1, 3) (3, 3)
 min: (-1, 3) and (1, 4, -1.8)
 inc: $(-1, -1) \cup (1, 4, \infty)$
 dec: $(-\infty, -1) \cup (1, 4, 1.4)$
 D: $(-\infty, \infty)$ R: $[-1.8, \infty)$

⑥ A) 4th degree (4 zeros) C) (0, -4)

B) (-4, 8) (3, 8) D) $x = -5, -2, 1, 4$

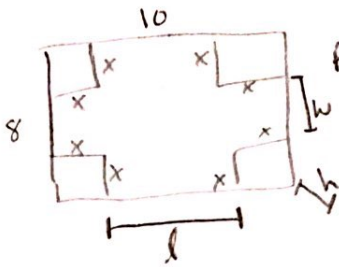
7) A) $f(x) = \frac{\sqrt{x+11}}{x^2+8x}$

*same as #1

B) $f(x) = \frac{x^3-1}{\sqrt{2x-3}}$

*same as #1

8)



A) $V = lwh$

$V = (10-2x)(8-2x)(x)$

C) $48 = (10-2x)(8-2x)(x)$
graph \rightarrow find intersection

$x=1$ $x=2$ $x=6$

*can't plug 6 into equation

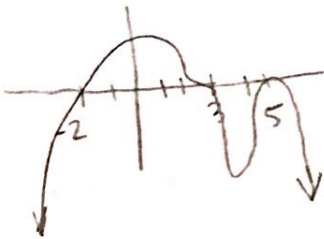
B) graph \rightarrow find max

$x=1.3$

9) A) $y = -(x-3)^3(x+2)(x-5)^2$

poly degree: $3+1+2=6$ (even, face down)

zeros/m: $3m3$ $-2m1$ $5m2$



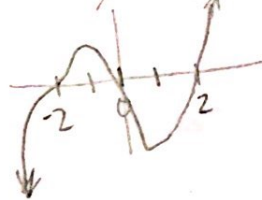
B) $y = x(x^2-4)(x^2+4x+4)$

$y = x(x+2)(x-2)(x+2)(x+2)$

$y = x(x+2)^3(x-2)$

poly degree: $1+3+1=5$ (odd, \downarrow)

zeros/m: $0m1$ $-2m3$ $2m1$



10) A) $x = -5$ m1

$x = -1$ m2

$x = 3$ m3

face down

$f(x) = -(x+5)(x+1)^2(x-3)^3$

B) $x = -3$ m2

$x = 1$ m3

$x = 3$ m1

$f(x) = (x+3)^2(x-1)^3(x-3)$

C) $x = -2$ m1

$x = 2$ m1

$x = 4$ m2

face down

$f(x) = (x+2)(x-2)(x-4)$

11) A) $f(x) = x^5 - 11x^4 + 6x^3 + 102x^2 + 9x + 405$

real: $x = -3, 5, 9$ complex: $\pm 3i$

$-3 \mid 1 \quad -11 \quad 6 \quad 102 \quad 9 \quad 405$

$\downarrow -3 \quad 42 \quad -144 \quad 126 \quad -405$

$5 \mid 1 \quad -14 \quad 48 \quad -42 \quad 135 \quad 0 \checkmark$

$\downarrow 5 \quad -45 \quad 15 \quad -135$

$9 \mid 1 \quad -9 \quad 3 \quad -27 \quad 0 \checkmark$

$\downarrow 9 \quad 0 \quad 27$

$1 \quad 0 \quad 3 \quad 0 \checkmark$

$x^2 + 3 = 0$

$x^2 = -3$

$x = \pm\sqrt{-3}$

$x = \pm 3i$

11b) $f(x) = x^4 + 6x^3 + 9x^2 + 14x - 30$

	1	6	9	14	-30
-5	↓	-5	-5	-20	30
	1	1	4	-6	0 ✓
1	↓	1	2	6	
	1	2	6	0 ✓	

Real: $x = -5, 1$ Complex: $x = -1 \pm i\sqrt{5}$

$x^2 + 2x + 6 = 0$

$\frac{-2 \pm \sqrt{2^2 - 4(1)(6)}}{2(1)} = \frac{-2 \pm \sqrt{-20}}{2} = \frac{-2 \pm 2i\sqrt{5}}{2} = -1 \pm i\sqrt{5}$

12) $f(x) = (x-2)(x-(3-i))(x-(3+i))$

$= (x-2)(x-3+i)(x-3-i)$
 $= (x-2)(x^2 - 3x - xi - 3x + 9 + 3i + xi - 3/i - i^2)$
 $= (x-2)(x^2 - 6x + 9 - i^2)$
 $= (x-2)(x^2 - 6x + 9 - (-1))$
 $= (x-2)(x^2 - 6x + 10)$
 $= x^3 - 6x^2 + 10x - 2x^2 + 6x - 20$

$f(x) = x^3 - 8x^2 + 16x - 20$

14) Use 13A

- A) $D: (-\infty, \infty)$
- B) $R: (-2, \infty)$
- C) $f(-8) = -(-8) - 4 = 4$
- D) $f(0) = -\frac{1}{2}(0) = 0$
- E) $f(11) = -1$

15) A) $x + \frac{6}{x} \geq 5$

$\frac{6}{x} \geq 5 - x$
 $6 \geq x(5-x)$
 $6 \geq 5x - x^2$
 $x^2 - 5x + 6 \geq 0$
 $(x-3)(x-2) \geq 0$

$(-)(-)$	$(-)(+)$	$(+)(+)$
0	2.5	4
+	-	+

$(-\infty, 2] \cup [3, \infty)$

B) $\frac{x^3 + 2x^2 - 15x}{x^2 - 9} \leq 0$

$\frac{x(x^2 + 2x - 15)}{(x+3)(x-3)} \leq 0$
 $\frac{x(x+5)(x-3)}{(x+3)(x-3)} \leq 0$

$(-)(-)(-)$	$(-)(+)(-)$	$(-)(+)(-)$	$(+)(+)(-)$	$(+)(+)(+)$
$(-)(-)$	$(-)(-)$	$(+)(-)$	$(+)(-)$	$(+)(+)$
-6	-5	-3	0	3
-	+	-	+	+

$(-\infty, -5] \cup (-3, 0]$

\uparrow zero \uparrow asymp. \uparrow zero

$$(16) f(x) = \frac{-2x^2 + 2x + 24}{x^2 + 3x} = \frac{-2(x^2 - x - 12)}{x(x+3)} = \frac{-2(x-4)(x+3)}{x(x+3)}$$

VA: $x=0$ HA: $y=-2$ Holes: $(-3, 0)$ Skirt Asym: None

$$x\text{-int: } 0 = \frac{-2(x-4)(x+3)}{x(x+3)} \quad \frac{-2(-3)^2 + 2(-3) + 24}{(-3)^2 + 3(-3)} = 0$$


$$0 = -2(x-4) \quad (4, 0)$$

$$0 = x-4$$

$$4 = x$$

$$y\text{-int: } y = \frac{-2(0)^2 + 2(0) + 24}{0^2 + 3(0)} \rightarrow$$

None

limits: 

$\lim_{x \rightarrow 0^+} f(x) = \infty$
 $\lim_{x \rightarrow 0^-} f(x) = -\infty$
 $\lim_{x \rightarrow \infty} f(x) = -2$
 $\lim_{x \rightarrow -\infty} f(x) = -2$

$$(17) f(x) = \frac{x^2 - 7x - 8}{x^2 - 8x} = \frac{(x-8)(x+1)}{x(x-8)} \quad x \neq 0 \quad x \neq 8$$

A) D: $(-\infty, 0) \cup (0, 8) \cup (8, \infty)$ B) $0 = \frac{(x-8)(x+1)}{x(x-8)} = \frac{x+1}{x}$ C) $x=0$

$0 = x+1$
 $-1 = x$ (-1, 0)

$$(18) P(t) = \frac{500 + 250t}{10 + 0.5t}$$

A) $P(10) = \frac{500 + 250(10)}{10 + 0.5(10)} = \boxed{200}$

B) HA $y = \frac{250}{.5} = \boxed{500 \text{ bears}}$

Standard 2.05 - key

① $r = 2 + 2\sin\theta$



② $r = 2 + 3\sin\theta$

$r = \sin\theta$

$2 + 3\sin\theta = \sin\theta$

$2 = -2\sin\theta$

$-1 = \sin\theta$

$\theta = \pi$

③ $(-12, 5)$

$r = \sqrt{x^2 + y^2}$

$r = \sqrt{(-12)^2 + 5^2}$

$r = 13$

$\theta = \tan^{-1}(\frac{y}{x})$

$\theta = \tan^{-1}(\frac{5}{-12}) = -22.62^\circ$

$(13, 157.38^\circ)$

$\frac{+180}{157.38^\circ}$

④ $r = 6\cos\theta$

$r^2 = 6r\cos\theta$

$x^2 + y^2 = 6x$

$x^2 - 6x + y^2 = 0$

$x^2 - 6x + 9 + y^2 = 0 + 9$

$(x-3)^2 + y^2 = 9$

⑤ $(\frac{x^2}{25} + \frac{y^2}{16} = 1)$ ⁴⁰⁰

$16x^2 + 25y^2 = 400$

$16(r\cos\theta)^2 + 25(r\sin\theta)^2 = 400$

$16r^2\cos^2\theta + 25r^2\sin^2\theta = 400$

$r^2(16\cos^2\theta + 25\sin^2\theta) = 400$

$r^2 = \frac{400}{16\cos^2\theta + 25\sin^2\theta}$

$r = \frac{20}{4\cos\theta + 5\sin\theta}$

⑥ 1) $4x^2 + 8y^2 - 8x + 48y + 44 = 0$

A) $4x^2 - 8x + 8y^2 + 48y = -44 \rightarrow$ ellipse

$4(x^2 - 2x + 1) + 8(y^2 + 6y + 9) = -44 + 4(1) + 8(9)$

$4(x-1)^2 + 8(y+3)^2 = 36$

$\frac{(x-1)^2}{9} + \frac{(y+3)^2}{4} = 1$

2) $y^2 - 12x + 18y + 153 = 0 \rightarrow$ parabola

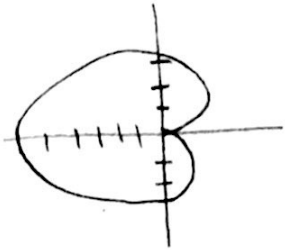
A) $y^2 + 18y = -12x - 153$

$y^2 + 18y + 81 = -12x - 153 + 81$

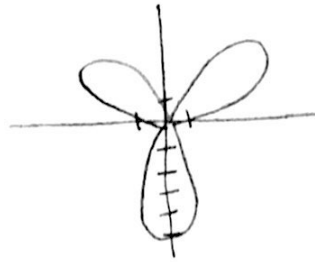
$(y+9)^2 = -12x - 72$

$(y+9)^2 = -12(x+6)$

7) A) $r = -3 - 3\cos\theta$



B) $r = 5\sin 3\theta$



C) $r = 2 + 4\sin\theta$

