Math 3 Quiz Bowl

1. $\sqrt[3]{12x^2} \cdot \sqrt[3]{126x^2}$

$= \sqrt[3]{1512x^4} = \sqrt[3]{(2\cdot2\cdot2)(3\cdot3\cdot3)\,7\;(xxx)x} = 6x\sqrt[3]{7x}$ (A)

126 12
42 3 3 4
6 7 2 2
2 3

2. $\frac{2(x+3)}{(x+6)(x-4)} \cdot \frac{(x+6)(x-4)}{(x-4)(x-3)} = \frac{2(x+3)}{(x-4)(x-3)}$ (C)

3. Graph, look for x-intercepts : $x = -5, 3, 4$ (B)

4. $\frac{x+3}{3(2x-1)} \cdot \frac{(2x-1)}{(x+3)(x-1)} = \frac{1}{3(x-1)}$ (D)

5. $h(x) = 2x$ $\quad h(g(x)) = h(3x^2+1)$ (B)

$g(x) = 3x^2+1$ $\quad = 2(3x^2+1)$

$= 6x^2+2$

6. $x = 3$ $\quad x = 4+i$ (A)

$x-3=0$ $\quad (x-4)^2 = (i)^2$

$(x-4)(x-4) = -1$

$x^2-8x+16 = -1$

$x^2-8x+17 = 0$

	x^2	$-8x$	$+17$
x	x^3	$-8x^2$	$+17x$
-3	$-3x^2$	$+24x$	-51

$= x^3-11x^2+41x-51$

7. $\ln 7 + 3\ln x = 5\ln 2$ (B)

$\ln 7 + \ln x^3 = \ln 2^5$

$\ln 7x^3 = \ln 32$

8. $(x-h)^2 + (y-k)^2 = r^2$ (B)

$(x-5)^2 + (y+1)^2 = 49$

9. $y = 151\,(1.013)^{2050-1950}$ (D)

$y = 288$ million

10. (B)

x	y
0	7.6
10	7.0
20	6.4
30	5.7
40	5.4
50	4.5

* Must change years starting at 0

Stat → Calc → 4

$y = -0.06x + 7.6$

11. (A)

$3x^2 - 7x - 20$

$2x+1 \;\overline{)\; 6x^3 - 11x^2 - 47x - 20}$

$-6x^3 + 3x^2$

$-14x^2 - 47x$

$+14x^2 + 7x$

$-40x - 20$

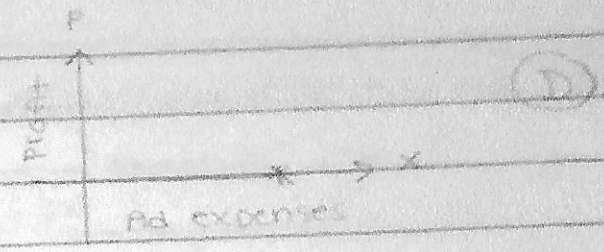
$+20x + 20$

0

12. (A)

$$\frac{\frac{x}{xy} - \frac{1}{xy}}{\frac{x}{xy} + \frac{1}{xy}} = \frac{\frac{x-y}{xy}}{\frac{x+y}{xy}} = \frac{x-y}{xy} \cdot \frac{xy}{x+y} = \frac{x-y}{x+y}$$

13. P = Profit
x = advertising expenses



(D)

As ad expenses increase, profit = 0.

14. $y = a(1+r)^t$

$y = 1.801(1+0.049)^t$

$y = 1.801(1.049)^t$

(C)

15. P = profit. Lose money means profit is negative. (D)

y-values

$P(x) = -750x^2 + 1500x$

* graph. look for x-values where y is negative

16. $A = \pi r^2$ * centers not a answer for area (D)

a) $r = \sqrt{12}$

b) $r = \sqrt{8}$

c) $r = \sqrt{6}$

d) $r = \sqrt{3}$ ← smallest radius = smallest area.

17. $-\frac{1}{2}|2x+6|+2=0$ graph, find x-int (C)

$x = -5, -1$

18. same

$x = 2y$ $x - y^2 = -2y$ $y(y-4) = 0$ $x = 2(0) = 0$

* use substitution → $2y - y^2 = -2y$ $y = 0$ $y = 4$

$2y = y^2 - 2y$ $x = 2(4) = 8$

$0 = y^2 - 4y$ solutions: (0,0) and (8,4)

19. a = vertical stretch (think pulling a hair tie) (A)
it gets skinnier!

20. $y = \frac{a}{x-h} + k$ Denominator = Left/right shift (A)
* think opposite!

21. $x = y - 9$ $f^{-1}(x) = x + 9$ (B)
$x + 9 = y$

22. $V = LWh$ * graph, find max $x = 1.8$ (C)
$V = w(w+2)(3-w)$ x = width y = volume $y = 8.2$

23. $N(t)$ = # of organisms at end $1000 = 1(2)^{t/3}$ $t = 13.3$ (D)
N_0 = starting # of organisms $\log 1000 = \frac{t}{3} \log 2$
t = time in days $\frac{t}{3} = \frac{\log 1000}{\log 2}$ $t = 29.86$

* can always graph and find answer in table

24. $4000 = 2000\left(1 + \frac{0.0525}{12}\right)^{12t}$ (C)

$2 = (1.0043\overline{75})^{12t}$

$\log 2 = (12t)\log 1.0043\overline{75}$

$t = \frac{\log 2}{12 \log 1.0043\overline{75}} = 13.23$ years

25. vertical Asymptotes are the restrictions left in the denominator! (C)

$$\frac{4x^2-100}{2x^2+x-15}$$

-30, 6, -5, 1

$(2x^2+6x)(-5x-15)$

$2x(x+3)-5(x+3)$

$(2x-5)(x+3)$

$4(x^2-25)$

$4(x-5)(x+5)$

$$= \frac{4(x-5)(x+5)}{(2x-5)(x+3)}$$

$2x-5=0$ $x+3=0$

$x=5/2$ $x=-3$

26. $x+2 = \frac{4}{x-2}$ (A)

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

$x^2-4=4$

$x^2=8$

$x=\pm\sqrt{8}$ $x=\pm 2\sqrt{2}$

8, 4 2, (2 2)

*cross multiply!

27. $y=(x-h)^2+k \Rightarrow y=(x-1)^2-2$ (B)

28. graph: $y_1 = x^3-6x^2-x+3$ $x=6.08$ (C)

$y_2 = 0$

Find the largest intersection

29. x^2+7x+5 (D)

$$x = \frac{-7 \pm \sqrt{(7)^2-4(1)(5)}}{2(1)} = \frac{-7 \pm \sqrt{29}}{2}$$

30. $3x-7\sqrt{x}+2=0$ (A)

$3x-7\sqrt{x}=-2$

$-7\sqrt{x}=-3x-2$

$7\sqrt{x}=3x+2$

$49x=(3x+2)(3x+2)$

$49x=9x^2+12x+4$

$9x^2-37x+4=0$

$(9x^2-36x)(-x+4)=0$

$9x(x-4)-1(x-4)=0$

$9x-1=0$ $x-4=0$

$x=1/9$ $x=4$

31. $y = a(1+r)^t$ (D)

$y = 215000(1+0.05)^5$

$y = \$27,440.05$

32. $(x^3 - x^2 + 3x - 3)$ (D)

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

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

33. $4x^2 - 21x - 18$ (B)

-72, -24, 3, -21

$(4x^2 - 24x) + (3x - 18)$

$x(4x-24) + 3(4x-6)$

$(x-6)(4x+3)$

34. $d = rt$ (A)

$d = 5(4)$

$d = 20$

35. Left 2 (C)

36. $\frac{x-1}{-x+5} \cdot \frac{x}{2x+10}$ (B)

$\rightarrow x \neq -5$

b/c it is a restriction!

$2x^2 - 2x + 10x - 10 = x^2 + 5x$

$2x^2 + 8x - 10 = x^2 + 5x$

$x^2 + 3x - 10 = 0$

$(x+5)(x-2) = 0$

$x = -5 \quad x = 2$

37. $\left(x^{\frac{3}{4}}\right)^3 = x^{9/4}$ (B)

38. $y = a(1+r)^t$ (B)

$y = 4000(1+0.03)^t$

39. $-2x^3 + x^2 + 1$ (A)

cubic function: Domain is $(-\infty, \infty)$ or all reals

40. $f(x) = 2x+1$ $\quad f(g(3)) \rightarrow \quad g(3) = (3)^3 = 27$

$g(x) = x^3$ $\quad f(27) = 2(27)+1 = 55$

41. Down (D)

42. $(x+yi) - (2-3i) = -6+4i$ (D)

$x + yi - 2 + 3i = -6 + 4i$

$+2 \quad -3i \quad +2 \quad -3i$

$x + yi = -4 + 1i$

43. $(x-h)^2 + (y-k)^2 = r^2$ (A)

$(x+2)^2 + (y-3)^2 = r^2$ $\quad (x+2)^2 + (y-3)^2 = 5$

$(-1+2)^2 + (1-3)^2 = r^2$

$1 + 4 = r^2$

$5 = r^2$

Distribute the negative as well!

get common denominators!

44. $\frac{\cos\theta}{(1-\sin\theta)} \cdot \frac{\cos\theta}{\cos\theta} - \frac{(\sin\theta)(1-\sin\theta)}{\cos\theta(1-\sin\theta)} = \frac{\cos^2\theta - \sin\theta + \sin^2\theta}{\cos\theta(1-\sin\theta)}$ (A)

$= \frac{\sin^2\theta + \cos^2\theta - \sin\theta}{\cos\theta(1-\sin\theta)} = \frac{1-\sin\theta}{\cos\theta(1-\sin\theta)} = \frac{1}{\cos\theta} = \sec\theta$

45. $x = 1.5^y + 4$ $\log_{1.5}(x-4) = y$ (C)

$x-4 = 1.5^y$

$1.5^y = x-4$ $f^{-1}(x) = \log_{1.5}(x-4) = \frac{\log(x-4)}{\log 1.5}$

46. $y = x^2 - 6x + 10 \Rightarrow$ 2 ways (B)

#1 Compute the □ $\left(\frac{-6}{2}\right)^2 = 9$

$y - 10 = x^2 - 6x$

$y - 10 + 9 = x^2 - 6x + 9$

$y - 1 = (x-3)^2$

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

#2 graph, find vertex

$(3, 1) \leftarrow (h, k)$

$y = a(x-h)^2 + k$

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

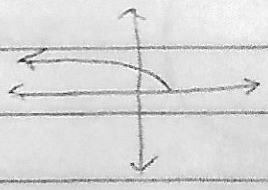
47. vertex: $(-2, 0)$ (A)

48. $-x + 2 = 0$

$-x = -2$

$x = 2$

$x \leq 2$ (B)



49. $y = \frac{a}{x-h} + K$ ← up/down (same) (B)

← left/right (opposite)

50. $d = rt$ $t = \frac{d}{r}$ car time = $\frac{210}{a-340}$ plane time = $\frac{1400}{a}$ (B)

Same time means car time = plane time: $\frac{210}{a-340} = \frac{1400}{a}$

$210a = 1400(a-340)$

$210a = 1400a - 476000$

$-1190a = -476000$

$a = 400$

51. $y_1 = (x^2-2x-3)/(x^2+5x$ (illegible)

look at table where $y = 0$ (A)

$x = 3$	$x =$
$u+3$	$u(u+3)$

52. $f(x) = 2x^2 \rightarrow g(x) = \frac{1}{2}x^2$ (A)

"a" gets smaller = vertical compression = wider

53. $h = -16t^2 + 16t + 5$ (D)

↑ y-intercept = initial height

54. f^{-1} means inverse. $f^{-1}(-3) = \frac{3(-3)}{4} + \frac{27}{4}$ (D)

$= 4.5$

$x = \frac{4}{3}y - 9$ ← inverse

$x + 9 = \frac{4y}{3}$

$3x + 27 = 4y$ $y = \frac{3x}{4} + \frac{27}{4}$

* Multiply by the conjugate of denominator to rationalize

55. $\frac{(4-\sqrt{3})}{(2-\sqrt{3})} \cdot \frac{(2+\sqrt{3})}{(2+\sqrt{3})} = \frac{5+2\sqrt{3}}{1}$ (B)

* Multiply denominator * in calc to save time

	2	$+\sqrt{3}$
4	8	$4\sqrt{3}$
$-\sqrt{3}$	$-2\sqrt{3}$	-3

$= 5+2\sqrt{3}$

56. $\frac{(3+6i)^2}{2i}$ * make life easy. use calc ; hit math → frac! (D)

$= \frac{18+27i}{2} \cdot \frac{36+27i}{2}$

57. $3\log x + \log 2 = \log 3x - \log 2$ (D)

$\log x^3 + \log 2 = \log 3x - \log 2$

$\log 2x^3 = \log \frac{3x}{2}$

58. a decrease = negative a (think opposite) = right (C)

59. $P = Kd$ $P = 0.43(25)$ (C)

$8.6 = 20K$ $P = 10.75$

$K = 0.43$

60. $6x^2 - x - 1$ vertical asymptotes are restrictions in the denominator! (D)

$(6x^2 - 3x + 2x - 1)$

$3x(2x-1) + (2x-1)$

$3x+1=0$ $2x-1=0$

$3x=-1$ $2x=1$

$x=-\frac{1}{3}$ $x=\frac{1}{2}$