Theta Applications
FAMAT State Convention 2002
Solutions, page 1

① x = 5th test grade

D $\frac{85+92+95+88+x}{5} \geq 90$

$360+x \geq 450$

$x \geq 90$ (D)

② x = Justin's time

C $\left(\frac{1}{8}+\frac{1}{x}\right)(2) = \frac{5}{8}$

$\frac{2}{x} = \frac{3}{8}$

$x = 5\frac{1}{3}$ (C)

③ h = altitude, b = base, A = area

C $h+b=187 \Rightarrow h=187-b$

$3551 = \frac{1}{2}b(187-b)$

$3551 = \frac{187}{2}b - \frac{1}{2}b^2$

$b^2 - 187b + 7102 = 0$

$b = 134,\ h = 53$

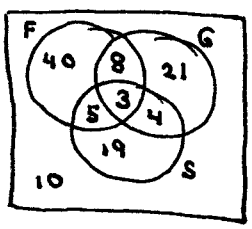
$134 - 53 = 81$ (C)

④ Solve for $E \Rightarrow E = \frac{180S}{\pi r^2}$

B Since 180 and π are constants, E varies directly with $\frac{S}{r^2}$

$\frac{S}{r^2} = \frac{3}{2^2} = \frac{3}{4}$ (B)

⑤



B ∪ Add all numbers.

110 (B)

⑥ $x = \frac{-1.4}{2(-0.035)}$

A $= 20$

$y = -0.035(20)^2 + 1.4(20) + 1$

$= 15$ yds. (A)

⑦ Let 1990 be year 0.

B Rate of change: FL $\frac{15993000-12938000}{10}$

$= 304,400$

NY $\frac{18976000-17990000}{10}$

$= 98,600$

Florida gains 205,800 people/year (304,400 − 98,600) and has 5,052,000 people to catch up.

$\frac{5052000}{205800} = 24.5$ years or 2015 (B)

⑧ x = kg. of LP#9

C $(.75)(62) + (.35)(x) = (.5)(62+x)$

$15.5 = 0.15x$

$103\frac{1}{3}$ kg. $= x$ (C)

⑨ $\sqrt{8^2+6^2} = 10$ miles (D)

D

⑩ $\frac{12(12-3)}{2} = 54$ strands (B)

B

⑪ Circular permutation - hold either a boy or a girl constant.

A $4! \cdot 3! = 144$ ways (A)

⑫ cylinder: $2\pi(4)(20) + \pi(4)^2 = 176\pi$

(note: top does not have to be painted)

A cone: $\pi(4)(5) = 20\pi$

(notes: ℓ = slant height = $\sqrt{3^2+4^2} = 5$, bottom does not have to be painted)

Total Surface Area: 196π

cans needed: $\frac{196\pi}{7\pi} = 28$ (A)

⑬ $h=-2$, $K=4$, the point $(0,2)$ is on the parabola

D $2 = a(0+2)^2$

$-\frac{1}{2} = a$

$a+h+K = -\frac{1}{2} + (-2) + 4 = 1\frac{1}{2}$ (D)

⑭ $85 = 64a + 8b + c$

C $115 = 100a + 10b + c \Rightarrow y = x^2 - 3x + 45$

$175 = 169a + 13b + c$ $= (25)^2 - 3(25) + 45$

$= \$5.95$ (C)

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(15) Hookemand Crookem
E $I = (1000)(.0525)(3)$
$= 157.50$
$A = 1000 + 157.50$
$= \$1157.50$

Idunnoh
$A = 1000(1.0125)^{12}$
$= \$1160.75$

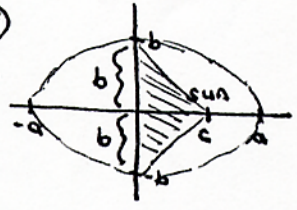
$1160.75 - 1157.50 = \$3.25$ (E)

(16) The ball will bounce $(.8)(80{,}000)$ or 64,000 ft. up after the first bounce. So, $t_1 = 128{,}000$ up and down.
A $S = \frac{128000}{1-0.8} + 80{,}000 = 720{,}000$ (A)

(17) TALLAHASSEE $\frac{11!}{3!2!2!2!}$
B $831{,}600$ (B)

(18) Equation transforms to:
C $\left(\frac{x-3}{2}\right)^2 + \left(\frac{y+4}{5}\right)^2 = 1$

$A_{ellipse} = \pi r_x r_y = \pi(2)(5) = 10\pi$ (C)

(19)
B 

$A = \frac{1}{2}(2b)(c)$
$= bc$ (B)

(20) vertex $y = -\frac{-8}{2(-2)} = -2$
A $x = 2$ $(2, -2)$

focus $\frac{1}{4m} = \frac{-2}{1}$
$m = -\frac{1}{8}$

$\Rightarrow (1\frac{7}{8}, -2)$ (A)

(21) $f(x) = \frac{(x-3)(x+2)}{(x+1)(x+2)}$
D hole: x-coord. $= -2$
y-coord. $= \frac{-2-3}{-2+1} = 5$

$(-2, 5)$ (D)

(22) $(0, 10), (2, 30)$
C $y = ab^x$
$10 = ab^0$
$10 = a$
$30 = 10b^2$
$3 = b^2$
$\sqrt{3} = b$
$\Rightarrow y = 10 \cdot \sqrt{3}^x$
$1000 = 10 \cdot \sqrt{3}^x$
$\log 100 = x \log \sqrt{3}$
$8.4 = x$ (C)

(23) $\frac{10^{8.3}}{10^{2.1}} = 15.8$ times (C)
C

(24) x = overtime hours
$808 = 16(40) + 24x$
C $9 = x$
$40 + 9 = 49$ hours (C)

(25) $SA = 4\pi r^2 = 4\pi(6378)^2 = 162{,}915{,}536\pi$ mi.
D (D)

(26) $r = \frac{2(50)(40)}{50+40} = 44\frac{4}{9}$ mph (B)
B

(27) ${}_{25}C_5 \cdot {}_{15}C_3 = 241{,}741{,}50$ (C)
C

(28) r = your speed
A $r\left(\frac{25}{60}\right) = (r-10)\left(\frac{1}{2}\right)$
$r = 60$ mph (A)

(29) rows 46-69: 3318 seats
rows 1-45: 5490 seats $\Rightarrow t_1 = 87.5 + (1.5)(1) = 89$
A 8808 total seats $t_{45} = 87.5 + (1.5)(45) = 155$
$\frac{200000}{8808} = \$22.95$ (A) $S_{45} = \frac{45}{2}(89+155) = 5490$

(30) alternate interior angles
A $2x = 72$
$x = 36$ (A)